THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXVI.—No. 16. Whole No. 1,141. | NEW YORK, MONDAY, APRIL 19, 1897. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, New York.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

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The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Twentieth Annual Meeting, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 13th, 1897.

The 20th annual meeting of the Western Gas Association will be held at Cincinnati, O., May 19th, 20th and 21st, 1897, and will be called to order by the President, Mr. W. H. Odiorne, at 10 A.M., Wednesday, May 19th.

The Grand Hotel has been selected as the headquarters for the members, and the sessions of the Association will be held in a suitable room contained therein. A rate of $3 per day, American plan, has been obtained; rooms with bath, extra. Those who desire cheaper rates can obtain them at the Palace Hotel, located on Vine and Sixth streets; rates, $2 to $2.50 per day; or at the Hotel Emery, European plan only, rooms, $1, $1.25 and $2 per day. It is advisable that all write and reserve their rooms in advance of the meeting.

The Executive Committee have arranged for the presentation of the following papers:

"Revivification of Oxide of Iron in Purifiers," by Mr. I. C. Baxter, Detroit, Mich.

"The Failure of the Commercial Attempts to Supply Fuel Gas in the United States," by Mr. F. H. Shelton, Chicago, Ills.

"Selling Gas," by Mr. I. C. Copley, Aurora, Ills.

"Leakage," by Mr. E. H. Jenkins, Covington, Ky.

"An Oil Tar Separator," by Mr. John R. Lynn, Detroit, Mich.

"Welsbach Street Lighting," by Mr. H. Wilkiemeyer, Evansville, Ind.

"Wrinkle Department," edited by Mr. Geo. Treadway Thompson, New York.

Mr. F. Egner, who is now in Europe investigating inclined retorts, or "slopers," will send a communication giving the results of his investigations.

The Central Passenger Association, Trunk Line, Southern Passenger Association, and the Chicago and Alton, from all points in Illinois, have granted rates of 1½ fare for the round trip, conditional on 100 certificates being presented to the Secretary for indorsement. The territory embraced by the above Associations includes all States east of the Mississippi river, except New England, and Wisconsin.

All persons attending the meeting will purchase a first-class ticket at starting point, paying full fare for same, obtaining from agent a certificate stating that the person whose signature appears on same has purchased at full tariff fare one first-class ticket to Cincinnati, which certificate, after it has been signed by the Secretary of the Association and a representative of the above Passenger Associations, will entitle the purchaser thereof to a one-third rate returning home.

All persons obtaining reduced rates must apply to agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but they may be obtained by request, if notification is made in time. Persons outside the territory embraced by Passenger Associations mentioned above should purchase a ticket to nearest point within said Association, and from there purchase a ticket to Cin-

cinnati, obtaining a certificate which will entitle them to a one-third fare returning to place from which certificate was obtained.

All queries sent to the Secretary for the Question Box will be assigned to members for answers.

A cordial invitation is extended to members of other Associations to meet with us, and to participate in the discussions of papers presented.

The Secretary will be pleased to answer any communications pertaining to the meeting, and will mail blank applications to any who desire to become members of the Association.

JAMES W. DUNBAR, Secretary.

BRIEFLY TOLD.

THE TWENTIETH ANNUAL MEETING OF THE WESTERN ASSOCIATION.—Secretary Dunbar's first circular, respecting the Twentieth Annual Meeting of the Western Gas Association, affords ample proof that its convention in Cincinnati next May will lack nothing in the instance of matter to carry on an interesting meeting from the technical point of its purposes as an Association. The paper list given contains six set numbers, and when the President's address and the Wrinkle Department are added thereto, no thought may be entertained that the Western's members are not as willing to work for their Association's sustaining and advancement, now that it is well on in years, as they were when building its foundations. One paper on the list (that promised by Mr. F. H. Shelton, on "The Failure of the Commercial Attempts to Supply Fuel Gas in the United States) is certainly opportune; for the fuel gas striker is considerably in evidence again in the East and in the West. Mr. Shelton, too, is just the man to compile this subject, for we have had from him at least two statistical papers of great value—on the history of illuminating water gas, and also on the gas engine. The arrangements for the transportation and housing of the delegates and guests have been made with promptitude and with an accurate perception of that which leads to comfort; wherefore it only remains to the visitors to write in time for their rooms that they may have the complete benefit of the Association's planning. We believe that the contributors to the "Wrinkle Department" have been tardy in forwarding their "copy" to Editor Thompson, and we further believe that a plethora of such contributions is not assured. Neither horn of such a dilemma should be in evidence. Those who have promised Wrinkles should forward them without delay, and those who have knowledge of Wrinkles not pledged for presentation should enroll themselves at once, both the tardy ones and the others making their earliest possible peace with Editor Thompson.

DEATH OF MR. P. J. SALMON.—With regret we report the death of Mr. P. J. Salmon, whose demise occurred in Dublin, Ireland, towards the close of last month. Deceased at one time was quite prominent in American gas circles, and although he was naturally a man of reserve, to the degree even of quietness, he nevertheless made and maintained many friends during his stay in America, who will share with us in regretting sincerely that his temporal time is at an end. Deceased, who was born in Dublin, Ireland, in 1846, eventually took service with the Alliance and Dublin Consumers Gas Company, and, in 1871, came to America and accepted a position with one of the New York city Companies. In 1875 he was appointed Superintendent of the Franklin (Ind.) Company, where his success was pronounced. In 1876 he joined the American Gas Light Association, and in the following year he returned to Ireland, having been invited by the proprietors of the Athlone gas works to assume charge of that plant. Later on (in 1888) he was promoted to the responsible position of Manager of the Galway gas works, which place he occupied up to his death. He was instrumental in forming the North of Ireland Association of Gas Managers, who subsequently named him to preside over their deliberations. Interment was made in Glasnevin Cemetery, Dublin, March 21st.

NOTES.—The franchise of the proposed gas company for Newport News, Va., has lapsed by limitation. The promoters were unable to raise the necessary capital.——The United Gas Improvement Company is adding a second set of the standard Junior Lowe water gas apparatus to the plant of the Plattsburgh (N. Y.) Light, Heat and Power Company.——At the annual meeting of the Flatbush (Brooklyn, N.Y.) Gas Company the following officers were chosen: Directors, Alonzo Williams, W. A. Stedman, A. Reed, Felix Campbell, Edward Johnson, C. L. E. de Gaugue and C. A. Bramley; President, Alonzo Williams; Vice-President, W. A. Stedman; Secretary and Treasurer, Arthur Reed.

The Commercial Uses of Coal Gas.

[By MR. THOS. FLETCHER, F.C.S., in the *Gas World*.]

During the last few years the importance of this subject has increased enormously, and the following notes, the result of over 30 years' daily experience, will no doubt be useful when gas engineers are consulted, as they will be more and more each year, as to the practical working results, advantages and drawbacks, of coal gas as a fuel.

The figures given are actual results obtained in practice. There are discrepancies in many cases, caused by local conditions and surroundings which interfere; but they may be taken as average results in commercial working with proper supervision. No attempt has been made to equalize or average the results, to make them correspond and appear correct. In the figures given as to the heating of branding plates, presses, calender rolls, etc., it must be remembered that the gas consumption refers to the total surface exposed, above and below, not the working surface only. I shall be pleased to answer any special inquiries or questions of any kind which will assist in developing what I am sure is the great future of the coal gas industry.

Economy of Fuel.—This, in workshop practice with coal gas, is a very serious matter. A defective or wrongly-planned arrangement may, and often does, increase the cost of fuel fourfold. Where possible the direct flame should be used. No more striking example of this can be given than the results obtained in heating ovens. For every square foot of exposed surface of a sheet iron oven, a burner placed under the sheet iron bottom will heat the oven 125° F. for every cubic foot of gas consumed per hour. The same burner placed inside the same oven will heat it 250° F., and if the oven with the flames inside is jacketed with 1-inch thickness of slag wool the rise of temperature will be 430° F.—*i.e.*, 3½ times the work for the same gas consumption. The same remarks apply to all classes of work; a plate for tempering cutters and small tools requires a gas consumption of 6 cubic feet per hour for every square foot of surface to heat it to 430° F.; if the plate is removed, one-half the gas will do the same work. But in practice it is almost impossible to get a perfectly equal heat without the plate, and therefore the double gas consumption may be an actual economy. Every case must be judged in the light of the necessities and conditions to be met.

A great change has come about during the last few years in the ideas of commercial users of gas, and the consumption is now taken as a very secondary matter as compared with the results. But the gas engineer must not lose sight of the fact that the most economical arrangement is the best advertisement, and the one which encourages other possible consumers. It is now no unusual thing to find in small and insignificant looking works rows and batteries of furnaces consuming from 100 to 400 cubic feet per hour each; and these are kept working throughout the day, year after year. I am within the mark in saying that for every one in use at present there is an opening for fifty. Possible users only need to have their requirements known and thoroughly worked out; the result is certain, and once a consumer sees what can be done extensions are certain; he never goes back to the old style.

Gas Supply Pipes.—An ample area of pipe is of importance, especially for burners and furnaces used without a supply of air under pressure, as the full gas pressure must be available at the burner jet. The following table may be taken as a guide:

Bore of Pipe.	Greatest Length which should be used of this size pipe.	Gas supplied by pipe to burners per hour.
⅜	20 feet.	18 cubic feet.
½	30 "	36 "
⅝	40 "	72 "
¾	50 "	120 "
1	70 "	200 "
1¼	100 "	360 "
1½	150 "	600 "
2	200 "	1,200 "

When air under pressure is used, the pressure of the gas supply is unimportant, as a blowpipe or blast burner will exhaust the gas from the pipes, and a much larger quantity of gas can be obtained from the same service, provided the pipes are large enough to let the required amount pass.

Continuous Heating.—When a vessel or chamber has to be kept at a steady given temperature for any length of time, the heat required for this depends on the area of the outside surfaces of the vessel. The greatest loss is from a surface of black iron. Careful jacketing with slag wool will reduce this to one-half. The loss from polished metal surfaces

will probably be between these extremes. Draughts, of course, must be provided against.

For every square foot of exposed surface of the chamber or vessel, if this is dull iron, internally heated—

1 cubic foot per hour is required to maintain a rise of 250°.
2 " feet " " " " 500°.

This rule does not apply to flat metal plates, as the heat rising up the sides of the vessel is lost, and therefore flat plates require a larger gas consumption.

Tube Burners.—These are required for many purposes, and, if properly made and proportioned, the following table gives, approximately, the gas consumption of each size at 1-inch pressure at the jet:

Bore ¼-in.	8 cu. ft.	per hour.		Bore 1¼-in.	75 cu. ft.	per hour.	
" ⅜ "	12	"	"	" 2 "	100	"	"
" ½ "	17	"	"	" 2½ "	150	"	"
" 1 "	25	"	"	" 3 "	220	"	"
" 1¼ "	40	"	"	" 3½ "	300	"	"
" 1½ "	55	"	"	" 4 "	400	"	"

The length of the burner does not affect the total power, which depends entirely upon the bore of the tube used.

Burners with Air Under Pressure.—The gas consumption and power of the above are doubled with an air pressure of 2 ozs. per square inch, 3½ times with 7 ozs. per square inch air pressure, and 7 times with 1¼ lb. per square inch air pressure; the burners in every case being the same size and proportions in every detail, the gas jet of the draught burner being used as the air jet and a separate gas inlet being provided. The above is not by any means the limit of power of blast burners, but it shows the differences in the same burner caused by altering the air pressure only.

Heating Power of Gas.—Approximately 1 cubic foot of 18-candle coal gas = 2 cubic feet of water gas, or 4 cubic feet of Dowson gas. The flame of the latter has a very low temperature, unless used with air under a heavy pressure, at least 1 lb. per square inch, if a red heat is required. Carbureted water gas has, approximately, the same power as ordinary coal gas.

Approximately 1 cubic foot of coal gas will
Melt 2 lbs. of ice.
Heat 1 gallon of water 50° F.
Evaporate 6½ ozs. of water.
Heat 1,500 cubic feet of air 30° F.
Boil 1½ pints of water.
Keep an iron plate 1 foot square at 380° F. for 15 minutes.
Keep an iron plate 1 foot square at 430° F. for 10 minutes.
Melt 2 lbs. of lead in a light ladle.
Braze together two lengths of ¼-inch iron or ¾-inch brass tube.

Drying by Heated Air.—The rule given under "Economy of Fuel" applies also in this case. If the direct heat is used along with the products of combustion, the following rise of temperature in the air has been found in practice, in the same apparatus, under the same conditions:

1 cubic foot of gas per hour will heat					2,460	cubic feet of air		20°
2 "	feet	"	"	"	2,940	"	"	30°
4 "	"	"	"	"	3,900	"	"	48°
8 "	"	"	"	"	4,980	"	"	75°

above the initial temperature of the air. If the products of combustion are excluded, an average of about double the above gas consumption will be required in any except the most elaborate arrangements, which, as a rule, are costly, and unsuited for ordinary commercial practice.

It is important to remember that, for heating air, illuminating and atmospheric burners have precisely the same power, when the direct flame is used; and for dyers and cleaners, ventilating shafts, and many other purposes, ordinary lighting burners are, beyond comparison, the best in daily work. Of these the best results are obtained by Bray's No. 2 or No. 3 union jets.

Press Heating, Calender Rolls and Branding Machines.—Branding, hosiery, bookbinders' arming presses, and others of similar class, require special management, and as many of the presses in use are designed by engineers who have no knowledge of the conditions necessary for gas fuel, it is sometimes impossible to design satisfactory and economical arrangements without full working drawings and sections. Where the heat has to be applied underneath only, the matter is very simple. Almost any ordinary burner will do the work required, provided proper arrangements are made for the escape of the products of combustion without smothering or baffling back. In most cases the upper plate or die also requires to be heated, and two methods need consideration. Where the plate is small, horizontal holes are drilled across the body of the plate, usually about 1-inch bore, and in these are inserted tubes drilled with a row of holes and giving an atmospheric flame. As these cannot ventilate themselves, the result is unpleasant, and the only way to overcome this is to use an ordinary tube Bunsen burner, not more than a quarter the diameter of the hole, fixing this outside at a little distance from the hole, and directing the flame inside. This causes a steady current through, and gives a satisfactory result. The other method is to direct downwards onto the plate one or more blowpipe flames, which strike the plate, and give much the best results. It may be taken as a rule, with very rare exceptions, that an ordinary atmospheric flame without air under pressure cannot be directed downwards to give satisfactory results. A rather curious exception to this is the ordinary self-heating smoothing iron, but this is caused by the fact that the upper side of the body of the iron takes up a considerable amount of heat and conducts it to the lower face, where it is utilized.

The required gas consumption for heating plates and dies is, for every square foot of exposed surface—*i. e.*, total area of radiating surface on all sides—1 cubic foot per hour for 280° F., 2 cubic feet for 380°, 3 cubic feet for 430°, 4 cubic feet for 470°, 8 cubic feet for 550°, 12 cubic feet for 620°. If no air under pressure is used, the great loss in the high temperatures is not caused by loss from radiation only, but principally from the fact of the smaller difference between the temperature of the plate and the temperature of the flame; and for this reason the use of air under pressure, with a consequent higher temperature of flame, is advisable as a matter of economy, for very hot work. The two first are respectively used for slow and quick running calender rollers, the two next for stereo moulds, and the last for branding presses, which latter may be heated to a still higher temperature for quick work, with advantage.

Brands for stamping wood boxes, etc., can be satisfactorily heated by ordinary atmospheric burners, although not so economically as when air under pressure is used. The greatest practical difficulty in applying any burner is that, as a rule, the frame carrying the brand is not constructed in such a manner as to allow the free escape of the products of combustion, and in that case the flame is smothered, the heating is unsatisfactory, and the combustion imperfect. In case of complaint this is the first thing to be suspected. Usually the frames can be perforated to remedy this; but care must be taken not to weaken parts which have to bear heavy strains.

Hollow Calender Rollers.—Example: A roller weighing 1 cwt. requires to be heated to 300° and maintained at that temperature. Eight and one-half cubic feet of gas will be required to heat the roller to the required temperature, and if the size is 6 inches diameter and 2 feet long, 3½ cubic feet per hour will be required to maintain this temperature, exclusive of any loss by work done—such as drying wet fabrics, etc. The extra power required for this will be found under "The Heating Power of Gas." The above are results which have been obtained in practice under favorable conditions; but the subject is an extremely difficult one, and in many cases the rollers and burners are designed in such a manner that proper or economical heating is impossible. Every case must be dealt with on its own merits.

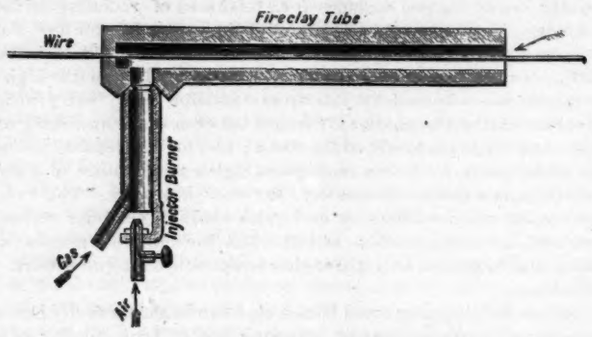
Boot Finishers' and Bookbinders' Tool Heating.—For this purpose very small burners are required, and with these, as with many other arrangements, there is a tendency to require an automatic arrangement which turns the gas down when the tool is removed. There are several practical objections to these, unless the burner is one of a comparatively large size, such as is used for tailors' irons. However strongly the automatic arrangement is made, it must be delicate and in good order to work satisfactorily, and the usual result is, after a few months, that it is either damaged and unworkable—sticking fast or leaking. These arrangements, however well made, or whatever the system, are, as a rule, out of order and not working after a few months, and they have, therefore, never become really popular.

Bakers' Ovens.—Serious attempts were made some years ago to heat ordinary bakers' ovens by coal gas, but it would appear that the predictions made at the time have been verified, and that the working cost has proved too great, in practice, for ovens worked on anything like a commercial scale, to deal with large quantities daily. For this work gas coke will be found a much more economical fuel. If the ovens were in continuous use night and day, the cost would be greatly reduced, the principal source of loss arising from cooling down when the oven is not in use. For ordinary use in commercial practice, coal gas cannot be recommended for bakers' ovens, unless for small and special work, where the cost of fuel is a secondary consideration. One frequent objection to gas coke is that the heat is too local and what the workmen call "spotty"—*i. e.*, too much in one spot. This can be remedied by

the addition of a small quantity, 20 or 25 per cent., of swift coal, which may be cheap slack, as the coke separates it sufficiently to prevent objectionable smoke. This mixture is a perfect one for domestic fires where great heating power is required.

The Wire Trade—Wire Cable Making.—The strands are liable to accidents in the machines, and in long cables the ends of the strands have to be joined. It has been the usual practice to remove the cable from the machine and weld the joint, a tedious and costly process. This work is now done by a small blowpipe, brazing a scarf joint with spelter. With steel wire cables, which have to be guaranteed to stand excessive strains and short bends, the proper solder is an alloy of 11 parts of silver and 13 parts of copper, melted together and rolled into thin sheets. This makes a joint as strong as the best steel, and one which will stand repeated bending or hammering out flat.

The following arrangement shows one of the simplest methods of hardening steel wires, dull. The gas consumption is very small. One



cubic foot of gas will heat 1 pound of iron wire to redness if the apparatus is well proportioned, and a very high speed can be obtained, two or three wires being heated in the same tube. The wire runs out of the closed end through a stuffing box into the side of a water tank, in which the water is sharply agitated, then out of another stuffing box on the other side over a long open flame, to anneal as required. The temperature of the water can, with care, be so adjusted as to obtain the right temper without annealing.

Bright wire hardening is done the same way as the above, but the wire must pass through a very small-bore iron tube to protect it from the flame, and a small jet of pure gas must be directed on to the open end of the tube to prevent the access of free oxygen to the wire whilst red hot. This method, of course, increases the gas consumption, as compared with the use of the direct flame. The tube is often used without a non-conducting casing outside, but this method is exceedingly wasteful. Pins, loops for wire cards, etc., which require to be softened in one part for bending or shaping, are best dealt with by a rocking blowpipe with a fine high pressure jet, annealing a short length as the wire passes, at distances depending on the speed of traverse and oscillation, the lengths being divided by a cutter geared to the feed and blowpipe rocker, after it has passed the blowpipe flame.

Welding wire ends cannot at present be done in an ordinary gas blowpipe flame with any certainty. Coal gas is too costly for annealing the commoner metals in large bulk, but it is satisfactory in every way for annealing silver and gold wire in iron annealing pots, with close-fitting lids, in a small furnace. With solid fuel this is a risky operation; with gas there is not the slightest trouble or risk.

Acid Chambers and Lead Cisterns.—The fusion or welding of the edges of the lead sheets does not now require the use of hydrogen gas. It can be done perfectly and rapidly by the use of a small blowpipe with a fine jet, using coal gas. The only secret in this is that, instead of the ordinary bellows, a small foot-blower, giving a heavier pressure of air, is required. This blower is sometimes used under the arm, like the bellows of a bagpipe, but it is better to employ a boy, so as to insure the steadiness of the hand using the blowpipe. The one drawback which must be considered in every case is that the required gas supply is often at a considerable distance from the work to be done. This can be overcome by the use of compressed coal gas in cylinders, which, when the amount of work to be done justifies the first cost of the cylinder, will be more economical than the use of a hydrogen generator using zinc and acid. Failures in this are common, but when they occur they are caused by deficient air pressure, or by the use of blowpipe jets too large for the purpose. With an air pressure of at least one pound per square inch, which can be obtained with a small foot-blower, and a blowpipe with a very fine air jet, the work is done as quickly and as well as with pure hydrogen. This is not a matter which will affect the gas works of the world, but it is well to know that, in large or small matters, gas fuel is equal to an emergency, and can hold its own.

[Concluded from page 567.]

The Prevention of Fires Due to Leakage of Electricity.

[A paper read by MR. FREDERICK BATHURST, A.I.E.E., before the Society of Arts, England.]

Results.—The insurance companies after their recitation of the danger conditions, add a paragraph by way of confirmation that no installation will be accepted by them as "a risk" in which all these conditions are not adequately provided against. It has already been stated that hitherto the experience of the English fire insurance offices has apparently been a singularly fortunate one, and although each office may hold records of the actual electrical fires which have come under its notice, no attempt (so far as the author is aware) has been made to classify in detail the causes which have produced them. Some inspectors may even urge that the fires have been too few to give real indication as to weak points in English wiring practice, but whatever the argument advanced, the utility of examining and considering the experience of some other country can hardly be questioned. The author holds therefore that the remarkably rapid and extensive development of the electrical industry in America, even though attended with a great number of electrically caused fires, may, if we are willing to make an unprejudiced examination, put us in possession of much practical and useful data which can well be studied with profit to ourselves.

In the United States the insurance authorities have been forced by their serious losses to establish a special bureau whose sole work is to examine and test electrical apparatus, collect and record particulars of electrical fires, and determine in detail their probable origin and cause. The results and deductions are very carefully arranged and tabulated in quasi-public reports.

An examination of the reports[1] of these electrically caused fires shows that a classification can be made under the headings we have already employed. We find that troubles from defective "insulation" or defective "conductivity" are included under the general term "conductors," whilst "inferior workmanship" includes constructive defects which occur in wiring material other than the conducting wires, as well as those arising from chance or accidental injuries. The records shows that defects in "conductors" cause nearly 70 per cent. of the total fires occurring, whilst "imperfect workmanship" accounts for the remaining 30 per cent.

If we arrange the headings in a tabular form, we find that the defects of conductors are ascribed to "crosses," "grounds" (earth leakage) and "short circuits."

In fairness to our comparison, however, we should note that fully one-third of the "conductor" troubles arise from "crosses" between the wires of different systems of electrical supply, such as telephone and telegraphic wires, with electric light or electric railway "trolley" wires, and between the two latter systems themselves. These fires have been caused by insulation breaking down before a very much higher voltage than that it was intended to withstand, and would not have occurred if greater precaution had been taken to prevent such possibilities. They occur in the United States on account of the method of overhead wiring, so largely followed for outside work upon the score of economy. They inculcate a lesson which may be taken as showing the wisdom, from a fire risk point of view, of the English practice of putting all out-door electric light or railway wires, underground.

Analyzing further, headings can be made showing that the "grounds" come chiefly from "structural iron work," "moisture," "metal pipes," "nails," and "over-loaded wires;" whilst "short circuits" result from "unprotected wires through floors," "flexible cords," "metal pipes, "fixtures" (chandeliers and electroliers) and "wood casing."

Upon analyzing the cases of fire which occur from "poor workmanship" and "defective material" we see that "imperfect contacts" and "connections" alone give rise to as many fires as all those occurring in the translating devices themselves combined.

Tables I. and II. give in synthetic form, the analysis of the conditions causing electric fires. The sub-divisions may be taken as representing approximately, equal number of fires, the most prolific cause in each section being placed first, the others ranging in relative order:

1. The author would here acknowledge his indebtedness to Mr. William H. Merrill, Jr., the electrician to the Electrical Bureau making these reports to the National Board of Fire Underwriters, for copies of same and permission to make extracts.

TABLE 1.—*Defective "Conductors" cause 70 per Cent. of the Electrical Fires recorded, as the result of—*

"Crosses" occurring with.	"Grounds" caused through.	"Short Circuits" arising from.
Telegraph or telephone wires with electric light wires.	Structural or other metallic work.	Unprotected wires through floors.
Do. with "trolley" wires.	Moisture (electrolytic trouble).	Flexible cords.
Electric light wires, with "trolley" wires.	Metal pipes (unprotected.)	Metal pipes and fixtures.
	Nails.	Wood casing.
	Overloaded wires.	

TABLE II.—*"Imperfect Workmanship" and Defective Materials Cause 30 per Cent. of the Electrical Fires, and are—*

"Careless" or "Accidental," recorded under.	"Inherent" or "Incipient," by reason of.
Imperfect contacts and connections.	Transformers.
	Safety fuses.
	Switches.
	Arc lamps.
	Incandescent lamps.
	Motors.
	Lightning discharges.

Deductions.—These records, when examined, give us not only a statement of the actual hazardous arrangement which was the cause of trouble, but point out also how the destructive effects could best be counteracted. They indicate, firstly, that "leakage" should be prevented as much as possible, and secondly, that the formation of any arc consequent upon "leakage" or "short circuit" should, if possible, be localized in its effect. Further, it shows the necessity of somehow preserving intact the insulation of the wire, even though the troubles incidental to a conductor may arise. Although, theoretically, we endeavor to provide an insulating covering which may be considered sufficient to withstand ordinary usage, the occurrence of fire from such causes as "structural metal work," "moisture," "metal pipes," "nails," etc., show the severity of the accidental conditions which may be encountered in practice. Wires are called upon to withstand damage from being dragged over rough floors, trodden upon by wiremen or laborers, and other untoward damage incidental to construction work. We know that the waterproofing and moisture-resisting qualities of the insulated wires in use, depend entirely upon the completeness of the covering, and also that the best material can be damaged by careless workmanship or unskillful manipulation; whilst it needs only the presence of moisture to set damaged insulating material on fire. We seek in practice to supplement this evident lack of essential mechanical qualities by providing that wires shall be installed in wood casing or metal pipes. But before examining the relative merit of these practices, should we not ask ourselves whether there is any possibility of gaining greater certainty from the insulating covering itself, by making some other disposition of it which may be better suited to the conditions arising within or without it? Paradoxical as it may appear at first sight, insulating material, inflammable, if simply laid *upon* a wire, can in a large measure be made *self-protecting*, if applied *about* a wire. Perhaps I can best illustrate the principle I wish to impress by taking an ordinary piece of paper, which is in itself inflammable and easily ignited from the flame of a lighted match. If the paper is now wrapped around itself so as to form a tube, although it can be ignited by an outside application of the flame it cannot be ignited by inserting the lighted match inside it. Practically it is impossible to maintain a flame, within the limits of a tube scarcely larger in diameter than the burning material itself. *Such an inclosure acts as a snuffer, and its quality of suffocating combustion is in a great measure independent of the inflammability of the material of which the snuffer may be composed.* May not this principle be applied to the insulation of electric wires in order to meet the condition that the over-heating of an electric conductor can set fire to the insulation around it? Having noted this fact, we reach the point of this paper to demonstrate the advantages of a method of wiring, which is in reality a well-worked out scheme of *supplementing* (perhaps eventually even supplanting) the present method of attaching the insulation to the wire itself, *by providing a system of insulating tubes* into which the conducting wires can be drawn. Incidentally also, it may be shown that such a system of insulating tubes is not, as some have asserted, simply an additional charge on the first cost of an installation, but one which from its sufficiency, "reliability," and immunity from break-down brings more than sufficient economical compensation to merit any additional cost.

Methods of Wiring.—As before stated, the inherent lack of mechanical strength in insulating coverings is recognized and some method of protecting them adopted. In England most of the electric wiring work has been installed in wood casing. Owing to the fact that the greater percentage of the work already done has been installed in old buildings which may be considered "dry," perhaps the slight property of mechanical protection that wood casing can give to an insulated conductor, may, in this class of work, be considered as being fairly well utilized. Wood casing, however, possesses many defects; it can absorb and retain moisture, and retaining it will rot. If leakage occurs, the wood being inflammable will first char and then take fire. Being combustible it also presents a medium for spreading and increasing a fire.[1] If desirous of proving the unsuitability of wood casing, the experiment should be performed of securing two conductors of opposite polarity on a wet board, when if the insulation on the wires has been damaged, it will be found that "leakage" readily takes place, and that so small a current as two amperes is more than sufficient to set the wood on fire. Tests made by the United States Electrical Bureau show that wood casing can absorb moisture to the extent of 15 per cent. of its weight, and that every kind of treatment in the way of "painting" or "impregnating" with moisture-repelling varnishes or fire-resisting compounds, must be considered ineffective, both from the electrical standpoint of "moisture-proofing," and from the fire insurance standpoint of "fireproofing."

The report on this matter expresses the opinion that wood is *undesirable* for "supporting or incasing electric conductors," and concludes with the significant remark that "it was to be hoped that fewer feet would be installed in future construction work." The main arguments advanced by advocates of wood casing are its ready applicability and its possibilities for decorative effects. Whilst these may perhaps have some merit if the location is dry and mechanical disturbance is unlikely, it will now probably be generally allowed that, in view of the uncertainty of maintaining the necessary conditions, wood-casing construction is certainly not applicable for new building work, and is certainly destined in time to be succeeded by more perfect methods.

Without wishing to make an evil prediction, the author would desire those insurance companies still upholding the use of wood casing to be on their guard lest they shall find themselves nurturing this practice under the *ægis* of tradition.

The demand for perfection in mechanical armoring has led to the introduction of ordinary iron pipes, and a considerable amount of wiring work is now going on in which the two electric wires are simply drawn into an iron pipe. The writer contends, however, that this is only an intermediate stage in the development of electric wiring, and that time will again demonstrate that the pipe protection must not only provide mechanical, but *electrical*, qualities also. In the case of plain, unprotected metal piping, we know that the effect of imperfect insulation on one conductor at a single point may be transmitted throughout the piping system, and await the occurrence of a second fault at any point upon the other conductor. When this occurs, unless the fuses happen to be small enough in size and act properly, it is quite possible that a hole can be "burnt out" of the pipe at one or even both of the defective points. Those who urge that "fusing" can give protection in the above condition surely ascribe greater perfection to this device than is consistent with absolute safety. Most of the fuses in practical use will easily carry from 100 to 200 per cent. more current than their standard rating. Generally also the placement of the fuse is left to the judgment or experience of the constructing wireman and afterwards to whoever may be in charge of the installation, and should it at any time become necessary to increase or enlarge the translating devices, there is no means of counteracting the desire to replace a small fuse by one of greater carrying capacity. In any case, when it is shown that overheating or leakage trouble can be obviated in a *more perfect manner*, I maintain that it is not the best practice to depend upon fuses as "safety" devices. Such fuse construction is certainly hazardous and seriously menaces perfect and uninterrupted service.

Again, those who state that they are willing to depend entirely upon the perfection of the insulating covering surrounding the conductors cannot surely have had practical experience with ordinary iron pipe construction. Anyone who has cut an iron pipe in two will allow that a "burr" is formed on the inside edges of the severed ends which is sharp enough to abrade or tear any insulating covering. This means that every piece of plain iron pipe cut up on an electric wiring job, must, if safety is to be insured, be carefully and effectively reamed out. It is *not* satisfactory to feel dependent for good service and safety upon

1. A conspicuous instance of this imperfection occurred so recently as October last at the Prince of Wales Theater, where a serious calamity was only averted by the effective action of those in charge.

this condition, for can we hope that every wireman will give exact and careful attention to this point? Or feel at ease in the hands of new or careless men? On the other hand, if an insulating lining *is placed inside an iron pipe*, it inherently provides against the most wilful carelessness that can be suggested or the worst "burr" that can be made.

With an insulating lining all doubt is removed as to the interior smoothness of the tube, and, providing the proper thickness of lining is chosen, no burr can be caused to cut through it into the inside of the tube. The possibility of moisture and electrolytic trouble is prevented and not only is the insulating material on the conductors placed under favorable preservative conditions, but the further safeguard is provided of an imperishable insulating protector permanently ensconced behind an effective iron armoring.

Furthermore, experience has demonstrated the necessity of insulating electric fixtures from the gas piping of the building, because if this is not done, a defect occurring on the electric fixture would be transmitted throughout the gas service. The insurance rules state that is "entirely inadvisable" to combine electric light fittings with gas fittings, and allow such practice only under the protection of an insulating joint. Surely those who would advocate plain iron pipe for electric wiring entirely overlook these determinations.

Many instances can already be quoted where the union of gas with electric fittings has resulted in disaster to both, either lighting agency having the ability to release the other. The author believes that practical experience will show that where gas or water systems are used concurrently in the same building with electric wires, unless an auxiliary insulation *is* provided between the insulated conductor and the metal piping spstem, unlooked for troubles will occur.

The main argument that can be advanced by plain iron pipe advocates—that of lower first cost—does not hold, if regard is given to uninterrupted service and to the future.

At the present time there are advocates to be found for "earthed" wiring systems, one method suggested being the use of a single insulated wire within an ordinary iron pipe. The pipe is to form the return conductor, and is to be guarded against as such. Under the conditions which pertain to such a system the advantages arising from an insulating lining inside the pipe are apparent, because any overheating of the conductor would be effectually guarded against, and there would not be the possibility of a "short circuit" burning out the iron pipe. It is also suggestive to notice that on such a metal pipe return concentric system an insulating joint at the fixture outlets would be entirely out of place, since its insertion would break the metallic continuity of the return circuit. Combination gas fittings connected with it would, therefore, present a fire hazard. On the other hand, a *bare copper wire* insulating lining metal pipe concentric system would have the advantage in these respects. Although an "earthed" wiring system can be advocated on the score of low first cost, the writer believes that the difficulties it introduces (if not insurmountable in extended practice) should only be approached with diffidence, and, therefore, prefers (for the present) to advocate a system in which both lead and return conductors are insulated and enclosed under the covering of an armored insulating tube.

Reasons for Advocating Insulating Tubing.—The wiring system thus advocated as best and safest would be a series of continuous tubes or conduits of insulating material which can be placed throughout a building after the manner of gas or water pipes, the conducting wires being afterwards drawn into the tubes. In this way the conductors are insulated electrically from all the materials used in the building, whether plaster, wood or stone work, gas or water pipes, etc., and the woodwork of the building is effectually protected from being ignited by "leakage," or the "accidental heating" or "short circuiting" of the wires themselves. The effects of "careless handling" or "defective workmanship" are also readily detected and remedied. For these reasons the building is effectually protected from the liability of fire arising through electrical service. Insulating tubes can be found which are waterproof, and will provide a high and durable insulation unattainable by any other method or at as low cost. Such a system can be installed coincident with building construction, and lends itself effectively to the placement, alteration, repair or enlargement of the conductors. A suitable metallic armoring provides protection from external trouble, whilst all internal trouble arising from moisture or damaged insulating material on the conductors are, from a fire risk point of view, absolutely counteracted. From a practical point of view, every desideratum is provided. Any defect in the tube construction itself would prevent the wires from being drawn in, so that the raceways themselves have to be mechanically perfect. The wires need not be brought into the building until all construction work is done, and are, therefore, not so liable to accidental damage, so that increased surety of insulation on the wire itself is obtained.

A perfect insulating tube should not be liable to decomposition by heat; should withstand moisture and resist electrolysis, be cheap, durable, pliable, strong, and not liable to shrink or warp. Such tubes can be produced, and are already commercially successful.

Many independent tests have been made by well known consulting engineers and others, in respect to the realization of the above advantages In order to reproduce the condition where the insulation between two wires in the same tube might break down, "arcs" have been formed in a tube, with the result that the arc was found to last only a few seconds, and affect the tube but slightly. To reproduce the condition where a conductor becomes heated through an excessive current, an insulated wire was placed in a tube and an increasing current passed through it until the conductor was burned out. The tube became heated, but was not set on fire. To reproduce the worst possible moisture conditions an armored tube was used, slightly bent and filled with water. After 24 hours' soaking, an insulation resistance measurement was obtained of 11 megohms, which was maintained as a permanent value throughout the series of tests, which were continued for several days. To prove the feature of "accessibility," a wire was placed in a tube, both were kept at a temperature of 190° F. for 50 hours and then allowed to cool. It was then shown that there was no sticking, and the wire could be withdrawn with ease.

Turning once more to the United States fire records, *one single fire* will be found recorded as having occurred upon wiring carried out in insulating tubes, whilst it is a fact that there are already many more lights installed in this manner *than for the total lighting of England*. The report of this fire, in detail, shows that an "unarmored" tube had been installed, and that this had been broken between floor and ceiling—probably through careless construction work—moisture was thus able to affect the insulation on the wires at the unprotected point, and a "short circuit" resulted.

In order to determine the merit of iron pipe *with* an insulating lining over plain iron pipe, the following tests have been made: A length of bare iron pipe and another of insulating tubing were taken, and two insulated wires run through both, under exactly the same conditions. These wires were short circuited, with the result that a hole was blown in the iron pipe, whilst the insulated iron pipe stood the test perfectly. A 150-ampere fuse was arranged in the circuit employed for this experiment.

Again, an ordinary insulated wire was taken and the insulation on it damaged—the wire was then run through both tubes—and in order to reproduce the conditions of moisture occurring, cotton waste impregnated with a caustic soda solution was applied to the damaged insulation inside the tube in both cases; the tubes resting on damp woodwork, side by side, about 4 inches apart. Between the tubes an iron bar was placed forming the earthed pole of a supply system. This arrangement was intended to reproduce the state of affairs that might obtain when the pipes were fastened to a floor board or wooden beam attached to the iron girders of a building.

Current was applied, and under the above conditions the "leakage" arising from the defective wire placed in the bare iron pipe, caused a fire to break out on the woodwork whilst the insulated iron tube stood the test without suffering or causing any damage. It was further found that a fire could be caused with such a small "leakage current" as 1½ amperes, a 3 light fuse placed in the circuit remaining intact.

Conclusion.—Perfect electric wiring should combine in the fullest degree the attributes of safety, accessibility, convenience, economy and durability. The author has endeavored to point out that an insulating tube method of wiring does provide "safety" by giving the greatest surety of action and freedom from the danger of fire. In respect to "accessibility," it provides for examination, replacement or repair to any part of the circuit with a minimum of trouble and expense. With respect to "convenience," the insulating tube is first fixed, due regard being given to the requirements of the building, and then completely fulfils its function of protecting the conductors. In regard to "economy," material utilized in the highest degree must admittedly be economical. Finally, as to "durability," a tube can be constructed, the materials of which are in themselves practically imperishable, and which at the same time find preservation for the conductors.

In short, it is thought that an insulating tube system fully meets the various conditions of safe and perfect wiring, compensating crass ignorance, and counteracting gross carelessness on the part of those installing or using the electrical service.

The true principle which should guide the insurance interests is really the *absolute prevention* of fire, inasmuch as any fire loss at all necessi-

tates that the community at large suffers—the rates charged being regulated from the total actual loss of the combined companies. The continued extension in the employment of electricity for power, light and heat must, if properly directed, tend to minimize the occurrence of any fires, and it is hoped that a case has been made out to show that an insulating tube or conduit system of wiring provides the best means of preventing fires arising from the leakage of current to earth, and the other causes of danger in electrical installation.

The "Economy" Water Tube Boiler.

In the design of the "Economy" boiler a decided advancement has been made over others of a similar type. Recognizing the merits of the water tube system, and its pronounced superiority and evident advantages, in the way of safe and economical operation, the designers have very wisely concluded to preserve the main features embodied in the older designs and make such improvements as have been suggested by engineers, who, in their daily experiences in handling large steam generating plants, have observed and noted the most common and annoying defects in the boilers under their supervision, and have devised means of correcting and eliminating them. As a result, the "Economy" boiler is as perfect a specimen of its type as present knowledge and skill can make it. The improvements have been general and are not confined to the boiler alone, but extend to the construction of the furnace and the manner of setting the boiler as well. The entire boiler is wholly suspended from steel girders carried by steel channel columns set flush with the front of the boiler, but perfectly independent of the brickwork.

This construction effectually avoids strains in any part of the boiler due to unequal expansion, and also protects the surrounding walls from damage so likely to occur when the columns are built into the wall. In this latter case the wall is practically dissembled throughout its entire height, rendering it very likely to crack and open up fissures that will, by allowing the inflow of cold air, materially affect the efficiency of the furnace. Another notable feature is the design of the dead plate. This plate is grooved upon its upper and lower surfaces, and is so made proof against buckling or bulging, thus constantly securing the jambs and pier block from displacement and injury. By the arrangement of the bridge and transverse deflecting walls, when properly and evenly fired, the furnace will undoubtedly prove very economical in fuel consumption, as perfect combustion of the furnace gases is certain to follow.

In the construction of the boiler many superior features are noticeable. The device for introducing and purifying the feed-water is admirable. By the system adopted the feed-water is first heated in the drum, although not coming directly in contact therewith, this being prevented by a surrounding larger pipe which freely communicates with the water in the main drum. The feed-water, after partially mixing with and absorbing the heat from the water in the larger tube, is made to pass by gravity into two inner circulating tubes over each section, receiving in its downward passage sufficient heat to raise it to a temperature favorable to the separation from its mineral impurities—which are precipitated into the mud drum—leaving the feed-water in a condition, both as to purity and temperature, that is safest for its admission into the lower tubes.

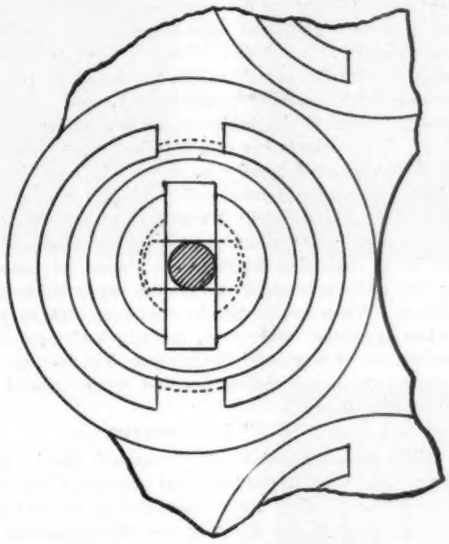


Fig. 1.—Outside View, with Yoke Removed.

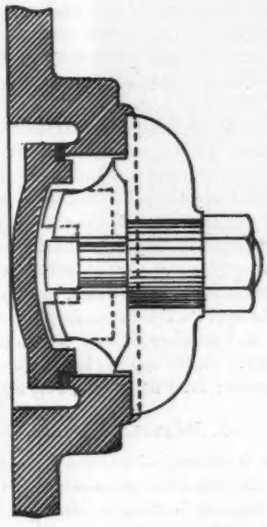


Fig. 2.—Section through Short Axis.

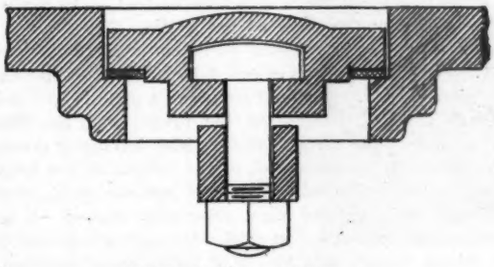


Fig. 3.—Under Side of Yoke.

Fig. 4.—Section through Long Axis and Yoke.

The water circulation is all that can be desired. The up and down-take areas are made appreciably larger than has heretofore been the practice, the result being a free and steady circulation, the minimum of incrustation and the maintenance of all parts of the boiler at a uniform temperature.

The hand-hole covers in the headers and opposite the tubes are very substantial and are so immeasurably superior to those of former designs that we illustrate their construction above.

To those who have had experience with water tube boilers the great improvement in this detail will be very evident. Being placed on the inside of the headers, the steam pressure, instead of having a tendency to open the joints, serves to keep them all the tighter. The cover being constructed to center itself with respect to the elliptical hole in the headers insures an equal amount of lap around the opening and pre-

vents the bolt from turning when tightening up the nut. Should a leak occur it can be stopped by taking up on the nut and tightening the cover, even under full steam pressure, without incurring the risk incident to covers of other construction—the bursting of the "cap nut" used and the blowing out of the entire hand hole plate.

Some Apparatus for the Technical Analytical Laboratory.

[By Mr. E. S. Johnson, in *Jour. Am. Chem. Soc.*]

Those branches of chemical industry which are dependent in part for guidance upon an analytical laboratory are each year becoming more exacting in regard to their demands upon the laboratory for accurate, yet rapid, work in large quantity.

Besides stimulating research with a view to shortening established methods of analysis, or the invention of new ones requiring less time for their execution, this exaction has resulted further in the introduction of much special apparatus for expediting the routine operations of the laboratory. A visit to any of the well-conducted technical laboratories of the day will show that much work of this sort has been done, and the frequent contributions on the subject in the contemporaneous journals of chemistry give evidence that activity in this direction is not abating.

It is the purpose of the present communication to present a few forms of apparatus designed in the first instance to facilitate and hasten the work of the technical laboratory with which the writer is connected. The efficient service which these devices have rendered induces him to venture upon their description with the thought that it may prove of interest to others engaged in the same field of work—the analysis of iron and steel. Although more particularly adapted to the special work mentioned, the apparatus, in some cases, may perhaps be found capable of advantageous application in connection with other branches of technical analysis, and possibly, in one or two instances, in the general analytical laboratory. In its application it concerns the operations of: I. Measuring Reagents; II. Filtration; III. Solution with the Aid of Heat.

I. Measuring Reagents.

As is well known, the technical analyst is constantly required to treat a large number of samples or solutions successively with a given quantity of some liquid reagent in order to obtain a solution, effect a precipitation, etc., *where great accuracy is not important.* Such manipulations may be speedily executed by the simple arrangement shown in Fig. 1.

A reservoir of several liters capacity, containing the reagent, is connected by a siphon with a measure, and the whole mounted upon a stand with castors. The stand *S* is of finished oak, and 10 to 11 inches in height. In its top there is a shallow circular space slightly larger in diameter than the reservoir *R*, which, in this case, is a 4-liter bottle. This sufficiently secures the reservoir in its position on the stand. The bottle is closed by a rubber stopper into which two glass tubes are inserted, *T* reaching to the lower surface of the stopper, and *M*, of ¼-inch tubing, which extends to the bottom of *R* and forms the siphon connecting with the graduate. The latter is provided at both ends with accurately ground stopcocks. At *V* is a vent through which air escapes or enters as the graduate is filled or emptied. In the upper end of the measure and directly under the opening in the stopcock, a short piece of tubing is fused. It directs the liquid as it enters the measure, preventing its running down the walls and consequent escape at *V*. A clamp attached to a stout wooden peg fixed in the under side of the top of the stand holds the graduate firmly.

Until the supply of reagent in the reservoir is exhausted, the apparatus is clearly ready for continuous service after the filling of the siphon. This, plainly, may be done either by applying pressure through *T* or suction at *V*, the lower stopcock being first closed. When used it is drawn to the edge of the work table, where the graduate projects slightly, and the reagent may be conveniently delivered into the vessels destined to receive it. As the level of the liquid in the reservoir falls, the rapidity of the flow from the siphon of course decreases. Should the delivery become too slow, a force pump (rubber bulb with valve) may be used to restore the failing pressure. When this addition is made, it is convenient to attach a piece of rubber tubing with a pinchcock at *T*. It allows of quickly relieving the pressure within the reservoir. A third tube bent like *T*, but having a small bulb in the outer shank, connects with the pump. The bulb is filled with cotton, which filters the air forced through the tube. Where reagents contain solids in solution, it is usually necessary, to avoid the sticking of the stopcocks, to clean them and the graduate directly after using, especially when some time must elapse before the apparatus is again used.

In some analytical work, it is desirable to be able to deliver larger volumes (200 to 250 cc.) than is possible with the arrangement just described. This, however, is easily adapted to the work indicated. The height of the stand remains the same. The reservoir has the same capacity, or may be larger, according to the demand made upon its contents. *M* may be of somewhat larger diameter with advantage; it no longer acts as a siphon, and merely connects reservoir and measure. The measure with its increased capacity is much longer than before, and is so placed that the outer end of *M* is above the level of the liquid in the filled reservoir. The upper stopcock may then be dispensed with, as the graduate is filled by means of the force pump and the flow of the reagent from *M* may be instantly stopped by opening the valve (rubber tubing with pinch cock) which is added at *T*. This and the pump, conveniences in the form of the apparatus seen in the figure, now become necessities.

By substituting for the graduate a burette, an extremely practical combination is obtained for *measuring small volumes accurately*. *M* must be made higher and dips about 1-inch into the burette without being attached to it. A disk of soft rubber with a hole to allow the passage of the tube, closely covers the mouth of the burette. Further, a second clamp is needed to retain the burette in a vertical position. It grasps the neck of the bottle at one end and the burette at the other, and is a simple adaptation of a familiar form of clamp. The filling of the burette, as need hardly be remarked, is conducted exactly as described for the arrangement with the larger measure.

This modification of Fig. 1 was devised for use in connection with the colorimetric determination of carbon in steel. It has so effectually aided in the work that it now seems almost indispensable. It is necessary for obvious reasons to do the work referred to in the draft chamber. When not in use, the appliance must be kept out of the way of other apparatus and work, usually back against the wall of the chamber, out of easy reach for service. The facility with which it may be moved to a convenient position when needed becomes here an especial advantage.

II. Filtration.

1. *Filtering Apparatus with Automatic Feed.*—For certain phases of the routine work of the technical laboratory, the necessary reagents require preparation in large quantities as an economy of time. This involves, as a rule, the filtration of solutions several liters in volume. With the device seen in Fig. 2, readily constructed from materials always at hand in the laboratory, such filtrations are rapidly executed with extreme convenience. Of the two bottles shown in the cut, the one on the right contains the unfiltered solution, while the other receives the filtrate and carries the filter noticed in the funnel held by the rubber stopper in the neck of the bottle. The filter is of thick felt formed from paper or asbestos pulp upon a perforated porcelain filtering plate.[1] The funnel is about 4 inches in diameter and has a carefully ground edge. For most purposes, a plate 1¼ to 2 inches in diameter will answer. Resting on the funnel with the filter is a second inverted one of the same diameter, also having a ground edge, and with a long stem bent to reach to the bottom of the bottle containing the solution to be filtered. A ring of soft rubber *R*, between the funnels, and their ground edges effectually secures an air-tight joint when external pressure is applied. It was first intended to use funnels with ¼-inch flanges as a means of fitting them together. The above simpler arrangement, however, as intimated, works perfectly. The end of the stem of the upper funnel has a lateral opening,[2] obviously that the solution may have unhindered entrance.

The preparation of the filter (making the pulps and forming the felt upon the plate) needs no explanation. When asbestos is used it should first be ignited. The fibers then become somewhat elastic and produce a spongy, rapid filter. The felts are usually three-eighths to one inch thick, according to the difficulty of the filtration, the thicker felts being used for the more obstinate cases.

The filtration is begun, after placing the parts of the apparatus as seen in the figure, by starting the filter pump. The bottle to receive the filtrate and the space enclosed by the funnels, as a result, are partially exhausted of air. The external air pressure now being considerably

1. O. N. Witt.: *Ber. d. Chem. Ges.*, 1886, 918. This exceedingly useful form of filter in the preparative work of the laboratory, particularly the organic laboratory, whether it be desired to clear a solution or collect a precipitate, has recently been used in my laboratory with advantage in certain *quantitative work*. By means of the pulp filter, tungstic hydroxide, for instance, a most troublesome precipitate to handle in large quantities, may be collected and washed with little difficulty.

2. Made by blowing a bubble in the tube at the desired point, rubbing it off, fusing the edge of the opening left, and cutting the tube through the center of the hole.

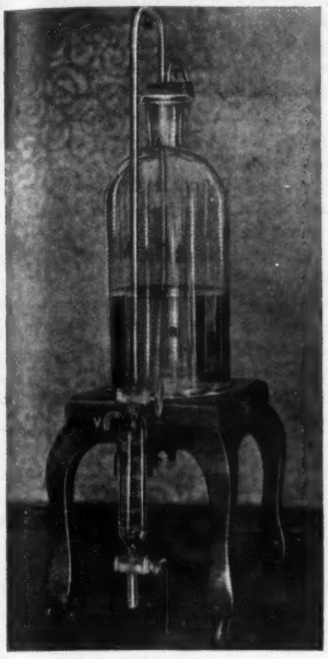


Fig. 1.

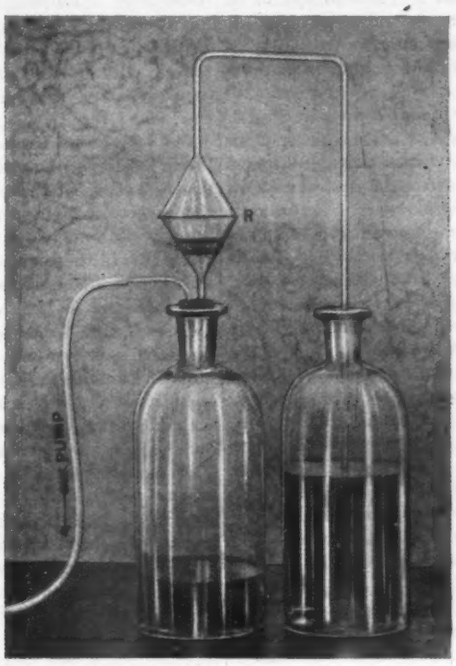


Fig. 2.

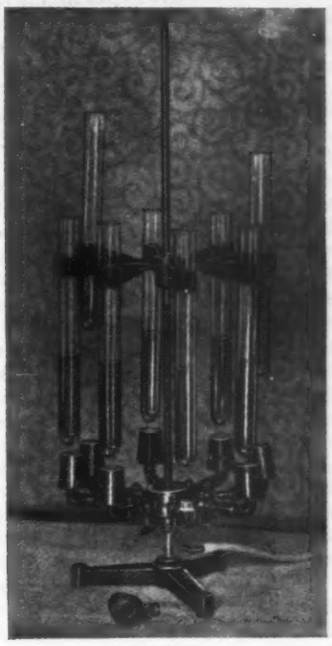


Fig. 4.

Fig. 3.

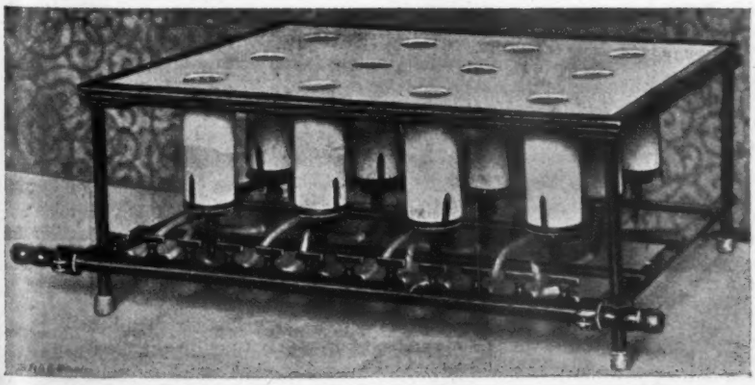


Fig. 5.

Fig. 6.

greater, the funnels are pressed forcibly together. The solution to be filtered rises and flows upon the filter, the flow continuing only as fast as liquid is withdrawn; the solution is thus automatically fed to the filter. The apparatus requires no further attention until the filtration is complete.

2. *A Revolving Filter Stand.*—This device is represented by Fig. 3. The tripod base carries a vertical steel rod about three-eighths of an inch in diameter and 8 inches high. Its free end is rounded and forms the pivot for the rest of the apparatus. This consists of a central column of brass and two disks of oak, each of three crossed layers. The column fits closely over the steel rod, and is 1 inch in diameter and 14 inches high. On its lower end is a broad flange to which the larger disk is attached. The disk is 19 inches in diameter and 1 inch thick, including the rim which projects about ½ of an inch. The upper disk is 10½ inches in diameter and ½ inch thick. It contains 15 tapered holes on the circumferences of an outer and inner circle, 12 in the outer and 3 in the inner. The holes are about 1½ inch in diameter on the upper side of the disk. Screwed to its under side is a flanged brass collar with set screw, by which its height on the column may be adjusted. Both disks are well finished and protected against moisture by outside varnish. When in use, sheet rubber covers are placed on them as a further protection. At *S* is a swivel with a clamp. It serves to hold the rubber tube through which liquid is supplied from an elevated reservoir for washing the precipitates and residues collected upon the filters. Through a small hole in the swivel at the base of the holder, the steel rod bearing the column and its disks may be oiled.

The stand, as described, was designed especially for handling the large number of ammonium phosphomolybdate precipitates obtained from the phosphorus determinations of the steel works' laboratory. The beakers are No. 1 Griffin's and the funnels 2 inches in diameter. Three of the 15 beakers with which the stand may be used are placed upon the upper disk during the filtration.

III. Solution with the Aid of Heat.

1. *Solution in Large Test Tubes.*—In Fig. 4 is shown an apparatus[1] devised for use in the colorimetric determination of manganese in steel. The part of the process here concerned involves the solution of the sample in nitric acid, heating the solution to boiling, and the oxidation of the manganese it may contain to permanganic acid by continuing the boiling after the addition of lead peroxide. The samples are dissolved in 10-inch by 1-inch test tubes, 8 solutions being made at once. The tubes are supported in a vertical position by a set of equi-distant clamps, modifications of a well-known form of spring clamp. They are of stiff sheet brass, as regards the jaws, and their shafts screw into a central cylindrical block of the same material. The whole revolves about the ¾-inch vertical brass rod of the tripod stand, and is supported by a similar block which may be fixed at any point on the rod by the usual set screw. Below the clamps are 8 Bunsen burners, radiating at angles of 45° from a short hollow cylinder which distributes gas to the burners. Their position on the axis is also adjustable. The burners are provided each with a stopcock and chimney. The manner of attaching the chimney is shown at *C*. To protect the apparatus from the corrosive vapors to which it is constantly exposed, it is varnished with special care; the polished brass parts with coach varnish, the iron base and copper chimneys with asphaltum varnish.

By the above construction and adjustments, the solutions in the test tubes may be brought almost simultaneously to boiling, and further treated as already pointed out. To arrest the boiling of the solutions a slight movement of the set of clamps to the right or left suffices; if it be desired to remove only a part from the action of the flames, the tubes are drawn up in the clamps as shown in two instances in the cut.

2. *Solution in Dishes, Beakers and Flasks.*—A few remarks of explanation in connection with Fig. 5 will make plain the construction of the apparatus here referred to. A rectangular iron stand 9 inches high, 25 inches long and 18 inches wide, forms its framework. This is built of an upper and lower frame, joined by legs of ¼-inch round bars. Low down on the legs is the lower frame, consisting of two end pieces through which the legs pass, and three similar bars at right angles to the end pieces. The bars of the frame are about 1 inch by $\frac{5}{16}$ in size. Its parts are substantially riveted together. Within slight limits it may be given a higher or lower position. Screwed into each of the longer bars are four Argand burners with 4-inch clay chimneys. The burners are connected by rubber tubing with the stopcock of the 1-inch brass pipe attached in front to the legs of the stand. The manner of connecting the tubing with the burners is best seen in the case of the middle row. Through the pipe in front, from either end, and its stopcocks, gas may be supplied to any one, part, or all of the burners. The 1st, 4th, 7th and 10th stopcock, counting from the left, connect with the rear row of burners; the 2d, 5th, 8th and 11th with the middle row, etc.

The upper frame, above the burners, bears a loose asbestos pad, which forms the top of the stand. It is rimmed with sheet copper, and has twelve 2-inch holes, each directly over a burner. Two cross bars in the frame, parallel to those in the lower frame, prevent a sagging of the pad.

The feet of the stand are shod with rubber (stoppers bored partially through with a cork borer) for an apparent reason.

To subserve the occasional cleaning and revarnishing to which the apparatus, used as it is in the corroding atmosphere of the draft chamber, must be subjected, the burners, as implied above, can be easily removed, and the gas pipe in front detached from the clamps which support it. Besides hastening solution, this device may also be used with advantage for certain evaporations and other operations which at once suggest themselves.

The compactness of the apparatus, the ease with which the flames are perfectly controlled, due to the position of the stopcocks, and a definite plan in their connection with the burners, the varied application of which it is capable, and its convenient portability, combine to make it a most useful appliance in the laboratory.

3. *An Apparatus for Use in the Determination of Sulphur in Steel by the Evolution Method.*—Although excellent forms of apparatus have been proposed for the purpose indicated, a description of the combination shown in Fig. 6 is nevertheless undertaken, it seeming to the writer to have advantages which apologize for its addition to the already numerous list which might be compiled from the literature of the subject.

That part of the familiar method for the determination, which the present apparatus was designed to execute, consists in dissolving the sample of metal in hydrochloric acid, and the passage of the gases formed through an ammoniacal solution of cadmium chloride. The contact of acid and metal results at first usually in a brisk evolution of gas. This, however, soon slackens, and is then restored to the desired moderately rapid rate by the application of heat. As the metal dissolves, heating fails to maintain a steady flow of gas. At this stage of the process, hydrogen is forced into the flask in which the solution is now nearly completed, and next heated to boiling. The hydrogen serves (as need scarcely be remarked) a double purpose; the residual gases in the flasks are driven rapidly into the cadmium solution, and the liability (especially when the attention of the analyst must be divided among a number of simultaneous determinations) of the latter's "striking back" into the flask, during the boiling, is entirely obviated.

The following references to the figure will make plain the relation of the parts of the arrangement shown by it to each other and the manipulations thus roughly sketched.

The 250cc. flasks *F*, in which the metal and acid are brought in contact, stand upon a light iron table 9 inches high, 7 inches wide, and 23 inches long. The top of the table is of asbestos board as in Fig. 5; under each flask, there is a 2-inch hole through which, obviously, heat is applied to the flasks from the burners below. A stopcock at one end of *G* enables the regulation of the supply of gas to all the burners. It is, however, essential for apparent reasons, to be able to perfectly control the supply to each burner separately. This has been effected, not by the use of the customary stopcock, but by a slight modification of the interior mechanism of the burner. This may be seen by unscrewing the stem at the milled ring. In the center of the circle which forms the inner end of the stem, is an ¼-inch opening, and at the circumference is a pinhole, both for admitting gas to the crown of the burner. When the parts (stem and crown) are in place, a ¼-inch disk faces the end of the stem, and is adjustable, in regard to its distance from the end, by means of the threaded shaft to which it is attached or, more accurately, of which it is a part. The shaft itself is shifted toward or from the end by the key underneath the crown. The motion toward the end at its limit brings the disk in contact with it, and more or less perfectly closes the larger opening; the pinhole being beyond the circumference of the disk remains open.

This construction does not admit of the required perfect control of the gas supply to the individual burner. The smallest quantity of gas that may enter produces generally too large a flame when little heat is needed, and the pinhole prevents entirely cutting off the supply. This difficulty is resolved and the burner completely adapted to the present purpose by merely closing the pinhole and placing a circular washer

1. Made by Messrs. Bullock & Crenshaw, of Philadelphia, to whom credit is due for the careful execution of the idea of the apparatus as conveyed in a somewhat crude sketch prepared during the hurry of remodeling and re-equipping a laboratory. The heating apparatus shown in Fig. 5 was also constructed by the same firm.

of soft leather, with a small segment removed, on the disk. If the crown and stem be now screwed together, the washer is compressed between the disk and the end of tha stem, tightly closing the remaining opening in the latter. Unscrewing the parts but slightly, relieves the pressure and renews communication between the stem and the crown. The manner of manipulation with the burner thus modified is plain. Additional comment is unnecessary.

The pipe *G* is strapped to the flat bar supporting it, by strips of brass fastened with screws, and is therefore readily detached. The bar is attached to the legs of the stand in the manner described for those carrying the burners in Fig. 5, and is also adjustable as regards its level. Four spring clamps projecting horizontally from the brass rail *R* hold the flasks securely in their places. The rail is screwed to the stand underneath the top frame. *R* further has two vertical clamps *J* similar to those just mentioned. They grasp the glass tube *H*, which is closed at one end by a rubber cap and connected at the other with a hydrogen generator. Through *H* hydrogen is distributed to the flasks. For this purpose there is a short branch opposite each flask. The neck of the flask is closed by a rubber stopper, through which pass three glass tubes. One of these, *h*, is connected by rubber tubing with the branch to which attention was called, and reaches to the bottom of the flask. The lower end is drawn out and bent upwards slightly. By means of a compressor, the rubber tubing making the connection may be opened or closed as desired. The dropping funnel *I*, for introducing the acid, has a wide-mouthed bulb large enough to contain the whole of the acid required for the solution; the stem holds a column of acid capable of more than overcoming the resistance offered by the solution in the cadmium chloride tubes, the 10 by 1-inch lipped test tubes, *A*. The tube *E* with two bulbs conducts the gases generated in the flask into the cadmium solution in *A*. The test tubes stand, in the rack *S*, upon a pad of sheet rubber.

Economy of space, the ease, nicety, and rapidity of manipulation possible with it, and the ability to use the device wherever the little space occupied by it may be found in the draft chamber, are its practical features. Where a large number of determinations must be made at one time the number of stands may be correspondingly increased and controlled by one operator.

Opinion of Justice Romer, in the Matter of the Validity of the Coze Patents.

The following summary of the opinion of Chief Justice Romer, of the English High Court of Justice, Chancery Division, in the matter of the Automatic Coal Gas Retort Company, Limited, v. the Mayor and Corporation of Salford, is from the *Journal of Gas Lighting:*

Justice Romer proceeded to give judgment. He said that, in his opinion, the plaintiffs were entitled to succeed. He thought the invention of the patentee was a novel and a very useful one, and was undoubtedly good subject matter for a patent. In substance, it was for new apparatus for making gas from coal. It could be applied for analogous purposes; and accordingly the claim was for "improvements in retorts for the distillation of gas from coal and other matters." But undoubtedly the chief object of the patent was the manufacture of gas from coal. Now, prior to the date of the invention, the system in use was one in which the retorts were placed horizontally. This position was adopted because it was very important, in the manufacture of gas, that the coal at the bottom of the retort should be lying substantially on the level, and be not too deep, so that there would be sufficient room for it, when heated, to expand, and yet leave sufficient space for the gas to pass off to the top of the retort. With horizontal retorts, the system of charging and discharging them was a very laborious one, and, as he gathered, required considerable skill on the part of the men who were intrusted with the duty. It required several men to do it, and it was comparatively slow work. The patentee's apparatus, or system, depended upon this: He took a retort at an angle approximating to that which he called the "angle of repose." As to this, he (the learned Judge) did not think there was much difficulty in seeing what the patentee meant. He meant at such an angle that when the coal was allowed to fall from the truck into the bent charging mouth, it would enter the retort at a certain velocity, and then distribute itself in a practically even layer over the bottom. As the coal entered, it went down the retort, and reached the stop which the patentee pointed out was to be used. It then impinged upon it, and the retort became charged with a layer of coal which was sufficiently level, and of the right height to be capable of being dealt with in the ordinary way. The advantages of the system were these: In the first place, it dispensed with labor, and was much cheaper than the usual method; secondly, the charging was substantially automatic, and the discharging was effected with great rapidity owing to the angle. The patentee showed a great many detail ways of carrying out his invention. Among other ordinary things he mentioned were the employment of hoppers for certain purposes, a movable shoot, and shoots of different shapes. The worth of the invention was shown by his system, from the time of its coming into use, practically entirely superseding the old one; and accordingly, so valuable was it, that, as usually happened in inventions of this kind, from time to time numerous modifications and improvements had been made. Some of these were for the use of movable shoes and baffle plates, to steady the supply of coal to the retort; and there were various devices for making the supply constant and regular, for diminishing the drop, and for slightly increasing the angle of the retort referred to in the specification.

So valuable was Coze's original invention, that many of these modifications had become so important as to deserve patents being taken out for them separately. To his mind, the novelty of the patentee's invention was very clear. Never before the date of the patent had any such apparatus or system been used for distilling gas from coal or any other heated matters. When the alleged anticipations were examined carefully, they were found to be in reality not anticipations. All they showed was that inclined retorts had for some purposes been used prior to the date of the plaintiffs' patent. He would refer to one or two of the important anticipations. He might say generally with regard to them that none showed how to produce on the bed of the retort an even distribution of coal or other substance, or considered or had regard to the advantages obtained by the patentee's invention. Take Newton's specification, for example.

In this case, the angle of the retort was substantially different from Coze's; it was about 45°. Coze's system was not only not shown, but was evidently not known to Newton; and certainly from him no one would be led to Coze's invention. Newton's invention would not, to his Lordship's mind, work on Coze's system, and would not produce such a layer of coal as was required for the purpose of manufacture according to the method of Coze, and generally adopted. As to Griffith's patent, which referred to the case of a retort used for the purpose of oil extraction, there the system of having an even layer was not required at all, nor was Coze's system pointed out in the slightest degree. Griffiths had, in fact, a horizontal retort with a slanting supply, and in no sense could it be called an anticipation of Coze's invention. To pass on to Carey, whose apparatus was for calcining bones, that was a system where no uniform layer at the bottom was required. It was not pointed out by Carey; and it was sufficient for him (his Lordship) to say that there was not the slightest indication of Coze's system—nothing in it which would lead anyone knowing Carey to the view of Coze's system for the distillation of coal. The angle of 32½° was used by Carey for very different purposes. He wanted it for the re-burning of charcoal. With regard to Wilson, he need only say that the angle he had tried was clearly one wholly outside Coze's invention. It was something under 60°, and that was about the angle he had shown in his drawings. No layer at the bottom of the retort was pointed out, nor was Coze's system in the slightest degree anticipated. Moreover, in his opinion, it would not work; and certainly it would not do so for the patentee's system.

With regard to Carpenter's specification and his paper in the *Journal of Gas Lighting*, his invention was a very different thing from that of Coze. It was not only not the Coze system, but it would not have led to that system. Indeed, it was practically obvious that it would not; for, though Carpenter's invention was known many years ago, and was tried for a certain period, it soon fell into disuse, and no one was every led by it for one moment to anticipate Coze's invention. In Carpenter's system, the coal was really made to enter the retort by pressure of screws, so as to cause a continuous motion. It had nothing to do with an automatic retort or the Coze system of charging. He thought, therefore, it was abundantly clear that were was no anticipation of Coze's invention; and in his (Justice Romer's) opinion, his specification was sufficient to enable any person desirous of doing so to carry it out. The defendants said that the invention as set forth in the specification would not work so as to be a practical success. Upon this point there had been evidence of a somewhat conflicting nature. To his mind, taking Fig. 1 alone, which was the patentee's primitive invention, it could be worked, but not so usefully or successfully, especially when a coal of mixed size was employed, as when the invention was used in connection with the other details. The patentee had really taken great care to explain in his specification the objects he desired to effect, and the means of effecting them; and he (his Lordship) thought it was not expecting too much for him to anticipate that there

would be reasonable skill and care on the part of the workmen to carry out his invention. The special ground taken by the defendants' objection to Fig. 1 and the patentee's invention generally, was that it would not produce a good even layer of coal when they took the extent of fall of the shoot shown in the specification, and the angle of the retort (that shown in Fig. 1 was approximately 29°). But it was perfectly clear that they could, if reasonable care was taken in seeing that the coal left the truck not in a great rush or slowly, but in substantially a continuous stream, practically carry out the patentee's invention so as to be very useful and a substantial success. Among other evidence which supported the defendants' view, he bore in mind what Mr. Swinburne said. He stated that it would be perfectly easy to secure a continuity of supply if it was seen to be desirable to have it. He (his Lordship) could not think that the desirability of having a continuity of supply from the wagon was something which was not obvious, and which ought to be specially referred to in the specification. Look at the care that was taken by the patentee to show what the result was. For example, he said there were many things to be considered. The angle of the retort, the velocity of the coal, the friction arising from the floor of the retort, the size of the coal, and so on. He specially referred to the portions of the complete specification set forth; and he need not refer to them in his judgment. He found, as a matter of fact, that the desirability of this particular supply of coal struck most people who had practically to work out the patentee's invention. And the evidence of Mr. Paterson was very noticeable, that he took Fig. 1 and worked it, and found that the charge was in every respect satisfactory. As a matter of course, he took care that his workmen should supply the coal in suitable sizes. He thought, indeed, everybody knew that, in order to ensure success, care should be taken as to the way in which the coal was supplied to the shoot.

With regard to the special difficulty in Fig. 1, it really concerned the shoot being built round by brickwork. The effect of this was that the heat had a tendency to block up the mouth of the shoot, by reason of the accumulation of tarry matter. No doubt this drawback did interfere with the value of the invention. But such a disadvantage ought to be set off against the advantages derived from the system. Because of it, he could not hold that the invention was wholly bad. Some people might prefer to use Fig. 1 in spite of its disadvantages. It therefore appeared to him that this objection on the part of the defendants failed. He had already pointed out that the invention worked better and more successfully with the other arrangements as shown in the specification, such as Fig. 14, and more especially with the improvements and modifications he had already indicated. But the fact that the invention, as now practically used, was the one with the subsequent modifications did not prove that the original invention was not useful; and the use of it with modifications did not enable the user to say he had not taken the benefit of it and infringed. It was said that the angle of repose of coke was, as a rule, slightly greater than that of coal, and that the angle of repose of coal would not enable the coke to be got out. But the difference of the angle between coke and coal was not very great; and practically, if they had such an angle as the patentee pointed out was useful for the purpose of charging, it would be so for the purpose of discharging also.

It was further said that the patentee only pointed to an angle of 29°; or, at any rate, not to a greater angle than this. But the patentee, in his specification, showed what he was thinking of. He had the inclined retort; and he wished to have the coal entering at the top of it with some velocity, to be caught by the stop, and then accumulated; and he wanted his angle to be such as to have these advantages. They could work the patentee's invention with an angle slightly above or slightly below the 29° mentioned in the specification. He had taken care not to limit himself to one hard-and-fast angle; but he pointed out that it was approximately that of repose. It was said that Newton's arrangement, with an angle of 32°, was practically the same, with not so big a fall. Very likely this was so. But substantially the patentee's invention was still there. He therefore held that the objections to the patent failed; and it only remained for him to consider the question of infringement. If they once looked at the defendants' model apparatus, and saw how it worked, the thing was at an end. They had made, he admitted, improvements in the details of carrying out Coze's invention. They might be useful modifications and improvements; but when the apparatus was looked at, it appeared to him impossible to say that they had not adopted the plaintiffs' system. In his opinion, they had done so. The defendants' apparatus was nothing more than the plaintiffs' system, with modifications. It would never have come into operation if it had not been for the patentee's invention. Their angle was 32°; but it was clear that this was not outside the invention. In addition to having a slightly increased angle, the defendants had a very modified drop. The velocity with which the coal went into the mouth of the retort from the defendants' shoot was less than it was in the arrangements shown in the patentee's Fig. 1; and he had no doubt, as he had said, that the defendants' modifications were very useful for the purpose of regulating the velocity of the coal, according to its size, so as to insure its being more evenly distributed over the floor of the retort. But the defendants had taken the whole of the patentee's real invention; and all their invention fell within Claim 1. They took the system and carried it out according to the details, subject to certain modifications. It was attempted to be suggested by some witnesses that in the defendants' arrangement there was no fall of the coal into the mouth of the retort; but such a suggestion was really absurd. There was such a fall, effected substantially in the same way by the operation of gravity, for the purpose of getting a certain velocity upon the coal, so as to allow it to fall down the retort, and form an even layer at the bottom. It appeared to him, therefore, not only that the patent was valid, but that the defendants had infringed it.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. CARL H. GRAF, writing to the JOURNAL, from Lawrence, Mass., under date of the 8th inst., says:

To the Editors AMERICAN GAS LIGHT JOURNAL: I cannot allow your criticism, in the JOURNAL of April 5th, on my paper on the "Extraction of Ammonia from Spent Oxide," to pass without a word, as I fear you have gained a wrong impression in regard to the object of the process described in my paper, as well as to the practice in vogue in the works with which I am connected.

As I understand your criticism, you believe that the oxide of iron is, in the case referred to, called upon to extract part or all of the ammonia present in the gas, instead of removing this impurity by proper apparatus before the gas reaches the purifiers. If this were so, the process undoubtedly would be of questionable value; but these are not the conditions, as, with us, the gas is properly cooled, scrubbed and washed, and yields a fair return of ammoniacal liquor per ton of coal before it reaches the purifiers.

I do not believe there is a gas works where all the ammonia is extracted from the gas before it reaches the purifiers, and it is this ammonia that passes the washer and is taken up by the purifiers that the process described in my paper would recover. Dr. Lunge, in his work on "Coal Tar and Ammonia," speaking of obtaining gas liquor from the hydraulic main and the scrubber, adds, "Some more of the ammonia condenses in the oxide of iron purifiers, and is hence contained in the spent oxide." In a table by Dr. Arnold, showing analysis of 8 different samples of spent oxide, we find that the average ammonia contained in the samples is .95, or nearly 1 per cent. Allowing that 1 bushel of oxide of iron will purify 120,000 cubic feet of gas, and that 10 grains of ammonia are deposited in purifiers for every 100 cubic feet passed, we would have in a bushel of spent oxide ammonia equal to 7 gallons of 10 ounce liquor, or nearly one third of what would be yielded by 1 ton of coal.

All the ammonia in the spent oxide is in the state of fixed compounds, which remain in the oxide just as free sulphur does, and will not leave it, unless subjected to considerable heat or to washing. The process of extracting the ammonia would ordinarily be used once in two or three years; but it is one that I feel sure it would pay anyone to use before disposing of his spent oxide.

MR. C. M. WILLIAMS, Superintendent and Secretary of the Butte (Montana) Gas Light and Coke Company, informs us that the following schedule of rates became operative on the 1st inst.:

Monthly Consumption.	Gross, per M.	Net, per M.
1,000 to 5,000 cubic feet.....	$2.50	$2.25
5,100 to 8,000 "	2.50	2.20
8,100 to 12,000 "	2.50	2.12½
12,100 to 16,000 "	2.50	2.07½
16,100 to 20,000 "	2.50	2.00
20,100 to 25,000 "	2.50	1.95
25,100 and over "	2.50	1.87½

The discount time expires on the 10th of the month, and no bill will be rendered for a month's consumption of less than 400 feet, which, of course, will be billed at the gross rate. The former gross rate was $3 per 1,000.

SECRETARY ALDRICH says that the Spokane Falls (Wash.) Gas Light Company will expend the sum of $20,000 this year in main extensions.

PRESIDENT KINGSBURY, of the Corning (N. Y.) Gas Company, has determined to engage in the supply of incandescent electric lights.

THE plant and franchises of the La Crosse (Wis.) Gas Light Company have been purchased by the local Edison Electric Light Company, which concern thus secures control of the central station artificial lighting of La Crosse.

AT a special meeting of the Board of Directors of the Cambridge (Mass.) Gas Light Company, called last month for the purpose of adopting a minute to the memory of the Company's late Treasurer, the following resolutions were adopted :

Resolved, That the Directors of the Cambridge Gas Light Company desire to record their high appreciation of the character of Adolph Vogl, our late Treasurer, so suddenly taken from us. By his ever faithful and devoted attention to the duties of his office for more than 10 years past, by his strict honesty, and his courteous treatment of those with whom his official position has brought him in contact, he has richly earned the respect and gratitude of the public, and especially of the Directors and stockholders of this Company, for whose interests he has so successfully cared.

Resolved, That the sympathy of the Directors is hereby tendered to the bereaved family, and that in token of our respect the Board of Directors attend the funeral.

Resolved, That these resolutions be entered on our records, and a copy be forwarded to the family of the deceased.

THE D. M. Steward Manufacturing Company, of Chattanooga, Tenn., write that they have sold 1,000 gross of their special burners to one New York city gas company in the past year. They also report many inquiries from all the large cities—the orders for lava tips being especially noteworthy.

THE Boston *Traveler* says that the Attorney-General of Massachusetts has decided that fire insurance companies cannot do an insurance business upon any other class of risk than fires. For some time insurance companies in Massachusetts have been attaching a rider to the policies, which reads about as follows: "This policy shall cover loss or damage by explosion to the property, whether fire ensues or not." Recently the State Fire Insurance Commissioner, Mr. Merrill, asked the Attorney-General as to whether in his opinion the companies could legally issue such policies, and, as above stated, his reply was in the negative.

LAST Friday afternoon Mrs. Sarah T. Rorer, of the Philadelphia Cooking School, gave a demonstration lecture on cooking by gas, in the Music Hall of the Harlem Opera House, 209 West 125th street, under the auspices of the Consolidated Gas Company. Mrs. Rorer, in her usual capable way, "demonstrated" to the perfect satisfaction of a large and intelligent audience how easily a "simple lunch" could be prepared with gas as the fuel. The lunch consisted of : Soup maigre ; panned chicken ; bread pate ; strawberry roll. The lecture last Friday was the first of four which Mrs. Rorer is under contract to the Consolidated Company to deliver this season.

EX CONGRESSMAN BENJAMIN DEAN, formerly prominent in the affairs of the South Boston (Mass.) Gas Light Company, died at his home, 935 Broadway, South Boston, on the morning of the 9th inst. He was in his 73d year.

THE executive management of the Kansas City, Missouri, Gas Company is as follows: Directors, M. J. Payne, R. M. Snyder, H. J. McGowan, J. Crawford James, J. T. Holmes, Thomas Dolan, George R. Turnbull, Joseph Bushnell, Samuel T. Bodine and Randal Morgan; President, M. J. Payne ; Vice-President, J. Crawford James ; Secretary, R. Macmillan ; Superintendent, George S. Clarke.

THE business headquarters of the Springfield (Mass.) Gas Light Company will hereafter be located in the Nayasset Club building on State street. The Company will maintain a full line of gas cooking and heating appliances, etc., in the new quarters, which are very eligibly located in the center of the business section of the city.

A CONTEMPORARY, in alluding to the changes wrought by politics in the office of Inspector of Mines, State of Kentucky, has this just mention of the situation : "Mr. G. W. Stone has been appointed State Inspector of Mines, of Kentucky, by Governor Bradley, to succeed Mr. C. J. Norwood, whose term has expired. Mr. Stone is known chiefly as a lawyer and politician, and has no practical knowledge of the duties of his new office. Mr. C. J. Norwood, who retires from the position after a service of 13 years, has been a most competent and efficient inspector, and was displaced for political reasons only. He was well fitted for the inspector's work by previous experience, having done much practical work in mines and served for several years as assistant on the Missouri Geological Survey. His retirement will be a serious loss to the miners and mine operators of the State."

THE Worcester and Marlboro Street Railroad Company, of Worcester, Mass., is erecting at Northboro, Mass., a new power station. The engine room is 55 feet wide and 63 feet long, and the boiler room is 45 feet in width by 40 feet in length. The roof, which is to be of gravel on plank, is to be supported by steel trusses. Messrs. Cutting & Bardwell, of Worcester, Mass., are the general contractors for the work, and the steel work will be constructed by the Berlin Iron Bridge Company, of East Berlin, Conn.

THE plant of the Spring City Gas Company, of Royersford, Pa., is to be sold at public sale on the 1st prox., a court order for the sale having been issued to Mr. William Rennyson, the assignee. Possession of the works will be subject to the balance of a lease for 20 years, held by Mr. Joshua J. Nix. The bonded indebtedness is close to $4,500.

MESSRS. A. M. Graham and J. W. Hinman have purchased a controlling interest in the Clyde (N. Y.) Gas Company, and will make much needed improvements on the plant.

THE Directors of the Amherst (Mass.) Gas Company have declared a semi-annual dividend of 3 per cent.

THE United Gas Improvement Company is building for the Saratoga (N. Y.) Gas, Electric Light and Power Company two sets of standard double-superbeater Lowe water gas apparatus of 800,000 cubic feet daily capacity. All of the old types of water gas apparatus formerly used by the Saratoga Company will be dismantled.

THE Carson City (Nevada) Coal Gas Company has discontinued the manufacture of water gas.

A CORRESPONDENT says that Mr. William H. Swindell, the Superintendent of Lamps and Gas, Baltimore, Md., has prepared in pamphlet form the law regarding the testing of gas meters in that city. The pamphlets were prepared to simplify replies to the complaints made to the Superintendent by those who declare that the gas meters on their premises are registering inaccurately.

THE protracted gas war at St. Joseph, Mo., is said to be at an end. The settlement was effected through the purchase of the plants and franchises of the St. Joseph Gas and Manufacturing Company and the St. Joseph Light and Fuel Company by an Eastern syndicate, which will reincorporate under one management the properties named.

AT an auction sale on the Louisville Board of Trade, 325 shares of stock in the Louisville (Ky.) Gas Company were sold at an average price of 90 per cent. The figure is at least 15 points less than its real worth.

AT the annual meeting of the Montreal (Canada) Gas Company the officers' reports showed that two semi-annual dividends of the usual amount had been declared ; that 11¼ miles of mains and services had been laid; that 900 services were put down ; that 1,235 meters (of which 711 were of the prepayment type) were installed, and that 466 gas cookers and 203 heating appliances, etc., had been put in service. Out of an authorized issue of $500,000 4 per cent. bonds, $350,000 had been sold at par, which the report cited was the highest price ever realized on a similar bond in Canada. The working account for the year, from February 29th, 1896, to February 28th, 1897, on the debtor side, aggregated $391,365, and a credit of $716,285. The balance sheet showed to credit $4,265,616, and on the debtor side, $1,255,616.

A CORRESPONDENT at San Francisco forwards the following clipping from the *Chronicle* of that city, dated the 7th inst.: "Patrons and those having any dealings whatever with the distributors of gas and electricity have made their last calls at the time-honored but inconveniently located, offices at First and Natoma streets, and 229 Stevenson street. Hereafter all business will be conducted at the handsome office building just completed at 415 Post street. To the harrowing effect of a grievance which must be told, and the depression which accompanies the payment for gas when burned through a 5-foot burner instead of the modest 3-foot, will not be added the vexation of

(*Continued on page* 610.)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.
PACIFIC COAST GAS ASSOCIATION.
TEXAS GAS AND ELECTRIC LIGHT ASSOCIATION.

TERMS:
SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

AGENTS:
New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, APRIL 19, 1897.

(*Continued from page* 609.)

spirit which attends a trip from the Western addition to that section of the city which was centrally located 40 years ago, and to which railroad companies have not especially directed their attention. Now it will be a privilege to pay bills, large and small, for the new building has the benefit of every invention devised for comfort, and may be reached by the system of transfers from every point in San Francisco. This move brings prominently into evidence the consolidation of the two great interests, the Edison Light and Power Company and the San Francisco Gas Light Company, which was effected in January last, after a year of consideration and negotiation. Until now the identity of the old Companies, as far as the public was concerned, was as distinct as in the years past. Each has been called by its designating name. From this on consumers will be impressed with the fact that they are dealing with the San Francisco Gas and Electric Company. But this change, which accentuates the new *regime*, will simply be renewing old acquaintance, for in the consolidation a very large percentage of the old officials and clerks have simply been readjusted. Joseph B. Crockett, late President of the Gas Light Company, and now executive officer of the combine, will be found on the first floor of the new quarters. Close to hand will be his Secretary, W. G. Barrett. All other officers and officials of the gas and electric interests will be found on the three upper floors, which are made comfortably accessible by an elevator. The basement apartments have been given to the gas stoves. Here every possible adjustment of these comforts for cooking and heating will be found. As an argument to show the possibilities of gas and electricity, these forces are used in numberless devices throughout the building, exemplifying their beauty, utility and comfort. All the plants will remain where they have grown through many years, the new building representing the official life only of these great enterprises."

Distribution of Temperature in Geissler Tubes.

Mr. R. W. Wood has been measuring the temperature in different parts of the discharge in a Geissler tube. The results of his observations are published in the *Physical Review* (November-December, 1896). A special design of bolometer was used for making the measurements. The sensitive part of the bolometer consisted of a loop of wire supported inside the tube on the end of the rod, which passed downwards through a column of mercury to the outer air. The loop could thus be moved up and down the tube to any point between the electrodes. The terminals of the loop were, of course, on the outer end of the rod. It was found possible to draw curves showing the temperature at all points between the two electrodes. In the unstratified anode light, the temperature was nearly constant for the greater part of the column, rising to a maximum near the middle, and falling off as the dark space was approached. The maximum was usually found when the light was on the point of stratifying, and sometimes at higher pressures. On nearing the dark space a decrease of temperature was always observed. The temperature dropped very suddenly on leaving the anode light, reaching a minimum near the middle of the dark space, a rapid rise to a maximum taking place when the blue negative light was entered. In the stratified anode light the temperature curve assumes a wavy form, the light disks being warmer than the dark spaces between them. The dark space in front of the cathode was explored in a tube at a pressure of 0.1 mm. On entering the dark space the curve falls somewhat abruptly to a minimum, and then rises again rapidly as the cathode is approached. If the electric energy consumed in the tube is wholly converted into heat, Mr. Wood's experiments indicate a steep potential gradient in the negative light, a medium gradient in the positive light, and an easy gradient in the dark space, a result which agrees with what is already known.

Liquid Ammonia from Gas Liquor.

The London *Journal* "notes" that a great part of the gas works ammonia which was at one time worked up to a highly saturated solution for refrigerating purposes has been superseded by the liquefied ammonia gas which comes on the market in iron cylinders. This ammonia, being in the highest possible state of concentration, is used in ice making machines without further treatment. Aspersions have recently been cast on its purity; and to combat these, Dr. H. Bunte and Dr. P. Eitner, of Carlsruhe, devised an analytical method for its examination, which is described in the *Journal für Gasbeleuchtung*. It is based on the evaporation through weighed potash drying tubes of a carefully weighed amount of the liquid ammonia. Notwithstanding statements—doubtless based on inexact analyses—that the commercial article contained large quantities of water, these investigators found only 0.49 per cent. of impurities in a sample from one of the largest producers. The impurities consisted partly of organic substances, so that the actual amount of water was very small indeed. By the ordinary process of liquefaction, the ammonia gas is carefully dried by quicklime before it is compressed, and water is scarcely a likely impurity of the liquid.

The Market for Gas Securities.

The feature of the week in the trading in city gas shares was Mutual, which, on an inquiry for a round lot of 100 shares, advanced to 250 bid. East River common also more than held its own, 57 being freely bid for it last Thursday. The other city gas shares were rather neglected than otherwise, although the figures in all were about at the level mark a week ago. Consolidated sold at 161¼, and closed (Thursday) at 160 to 161½. The well defined belief is that the graded bill will become law, although no positive statement to that effect can be made now, no matter what the "contractors" say respecting it. It is, however, a perfectly safe thing to assert, in case the bill is ratified in the Assembly, and is transmitted to Mayor Strong, that if he should return it with his objections to Governor Black, the Legislature meanwhile having adjourned, the Governor will undoubtedly sign it. The Governor has shown so far a clever, clean perception of the rights respectively inherent to "the people" and the corporations. Our strenuous advice to those who look to our market report for guidance in any measure is to purchase Consolidated, Mutual or Brooklyn Union, at "the market."

Brooklyn Union, on realizing sales for speculative account, declined to 103½, but the shares should on merit sell at least as high as the bonds, which are 111½ to 112. Chicago gas is enjoying a period of activity that causes many to think that some of the old-time operators therein are again in the swim. If such is the case we will have to keep quiet. Bay State, through a rather queer sort of manipulation, sold down to 8 Thursday. It is reasonably cheap at 15, for no sane individual has any license to believe that the Boston Gas Company can be held responsible for the damages that are to be paid in consequence of the recent disastrous gas explosion there. The conduit contractors and the street railroad folks will have the satisfaction of dividing these losses. The general list shows no particular change.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

APRIL 19.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	160	161½
Central	500,000	50	195	..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	210	..
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	250	..
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	..
Northern	150,000	50	85	.
" Bonds	150,000	1,000	..	98

New York and East River..	5,000,000	100	57	57½
Preferred.....	2,000,000	100	94½	95
Bonds 1st 5's.....	3,500,000	1,000	107	108
" 1st Con. 5's.....	1,500,000	..	99¾	100⅛
Richmond Co., S. I.....	348,650	50	50	..
" Bonds.....	100,000	1,000	..	..
Standard.....	5,000,000	100	94	95
Preferred.....	5,000,000	100	114	116
Bonds, 1st Mortgage, 5's	1,500,000	1,000	111¼	113⅛
Yonkers.....	299,650	50	130	.
Out-of-Town Companies.				
Brooklyn Union.....	15,000,000	100	103¼	104¾
" " Bonds (5's)	15 000,000	1,000	111¼	112
Bay State.....	15,000,000	50	7⅝	8¼
" Income Bonds.....	2,000,000	1,000	..	35
Boston United Gas Co.—				
1s Series S. F. Trust....	7,000,000	1,000	..	85
2d " " "	3,000,000	1,000	70	72
Buffalo Mutual.....	750,000	100	125	..
" Bonds.....	200,000	1,000	95	100
Central, San Francisco.....	2,000,000	..	95	..
Chicago Gas Co.....	25,000,000	100	81⅞	82
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	94	94¼
Columbus.....	1,069,000	..	72	74
1st Mortgage.....	1,085,000	..	..	96
Consumers, Jersey City....	2,000,000	100	78	..
" Bonds.....	600,000	1,000	101	103
Cincinnati G. & C. Co.....	8,500,000	100	201¾	202
Consumers, Toronto.....	1,600,000	50	184½	187
Capital, Sacramento.....	500,000	50	..	35
Bonds (6's).....	150,000	1,000	..	..
Consolidated, Baltimore....	1,000,000	100	59¾	60¼
Mortgage, 6's.....	3,600,000	..	107	107⅛
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's....	1,490,000	..	..	..
Detroit	4,000,000	..	22	..
" Con. Bonds.....	4,312,000	..	73½	74
Equitable Gas & Fuel Co., Chicago, Bonds.....	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	81	88
" Bonds.....	2,000,000	..	92	93½
Hartford.....	750,000	25	..	145
Indianapolis.....	2,000,000	..	130	135
" Bonds, 6's.....	2,650,000	..	105½	107½
Jersey City.....	750,000	20	180	..
Lafayette Gas Co., Ind.....	1,000,000	100	84	87
Bonds.....	1,000,000	1,000	92	95
Louisville.....	2,370,000	50	..	..
Laclede, St. Louis.....	7,500,000	100	23½	23⅝
Preferred.....	2,500,000	100	73	76
Bonds.....	9,034,400	1,000	97⅛	98
Little Falls, N. Y.....	50,000	100	..	100
Bonds.....	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.....	1,000,000	..	93	98
Bonds, 6's	4,000,000	..	123	..
New Haven.....	1,000,000	25	225	..
Oakland, Cal.....	2,000,000	..	53½	54
" Bonds.....	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage....	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City.....	500,000	50	..	175
Rochester Gas & Elec. Co..	2,150,000	50	..	..
Preferred.....	2,150,000	50	83	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	97¾	98¼
St. Paul Gas Light Co.....	1,500,000	100	79	81
1st Mortgage, 6's.....	650,000	..	84	87
Extension, 6's.....	600,000	..	..	..
General Mortgage, 5's..	2,400,000	.	88	90
Syracuse, N. Y.	500,000	25	..	..
Washington, D. C.....	2,000,000	20	220	.
Western, Milwaukee.....	4,000,000	100	64	67
Bonds, 5's.....	3,556,000		93½	95½
Wilmington, Del.....	500,000	50	180	183

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As Superintendent of Gas Works or Gas and Electric Light Works,

By a man 34 years of age. Sixteen years' experience in the manufacture and distribution of Coal Gas as Supt., and four years in the Electric line. Thoroughly competent to take charge of any plant, separately or combined. A practical mechanic, and understands the erection of gas plants and everything pertaining to the business. Not afraid of work. Salary no object until ability is proven. Best of references.

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On account of changing location of our works and purchase of larger holder, we have for sale a Single-lift **Gasholder,** 80 x 20 feet, capacity 100,000 cubic feet. Complete and as good as new. Now in brick tank. Built by Stacey Mfg. Co in 1889. Holder has cup on bottom for telescoping, and guide framing is arranged and punched for additional section. Can be taken down and re-erected in brick or steel tank, as may be desired. Will be sold cheap.

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A Small Gas and Electric Light Plant,

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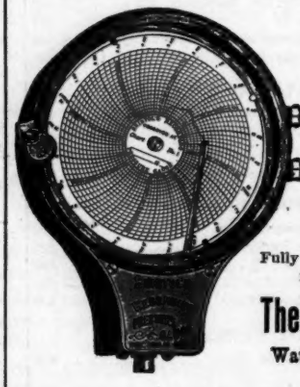

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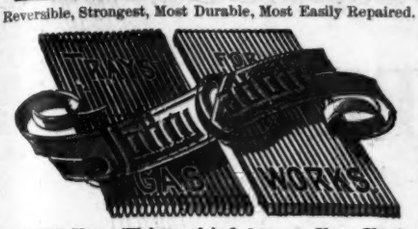

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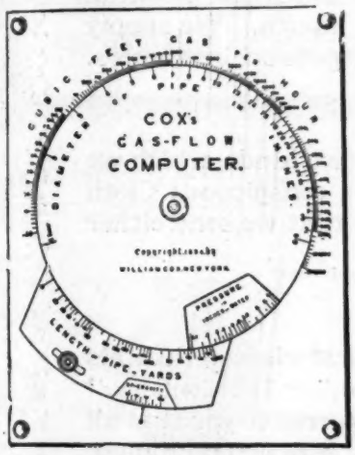

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We have just issued a handsome four-page Supplement to our Gas Range Catalogue. We shall be pleased to send you a copy of it if you have not already received one. It contains illustrations, descriptions and list prices of a new Detroit Jewel High Closet and High Shelf, a new Detroit Jewel Skeleton Frame Gas Stove and a large Portable Oven, and shows enlarged cuts of our new, elegant first-grade All-Cast Gas Range.

"Cooking by Gas."

We have already sent out this Spring, free of charge, to our customers, for distribution among possible users of gas for cooking, the entire first edition of our pamphlet "Cooking by Gas." This edition consisted of 100,000 copies. A second edition of the same size has been printed, and is going like the "hot cakes" of perennial fame. Have you asked for a supply? The pamphlet is freely conceded to contain the best matter of its class ever published.

Cheap Edition of Gas Stove Catalogue.

We have just issued for popular distribution a cheaper edition of our Detroit Jewel Gas Stove Catalogue, which is, in size, in appearance and in all essential particulars, like the handsome Catalogue we sent out last month. We supply the cheaper Catalogue in any reasonable quantity, free of charge to our customers.

Signs.

We have lately procured a supply of Detroit Jewel Signs of two kinds, which we furnish free to our customers on request. One is a large, conspicuous Cloth Sign, the other an elegant framed Glass Sign. Please note that we send either kind free to our customers on their asking.

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You must have seen the advertising we are doing in the first-class periodicals such as "The Ladies' Home Journal," "Harper's Magazine," "The Century," "Scribner's" and "The Youth's Companion," but has it occurred to you that all we are doing to popularize gas for cooking redounds to your benefit much more than to ours? We are trying to educate people to use gas in their kitchens so as to make a market for our stoves; but who makes the big profit in the end, we who make and sell stoves, or you who make and sell gas? And doesn't one good turn deserve the other good turn embalmed in the proverb?

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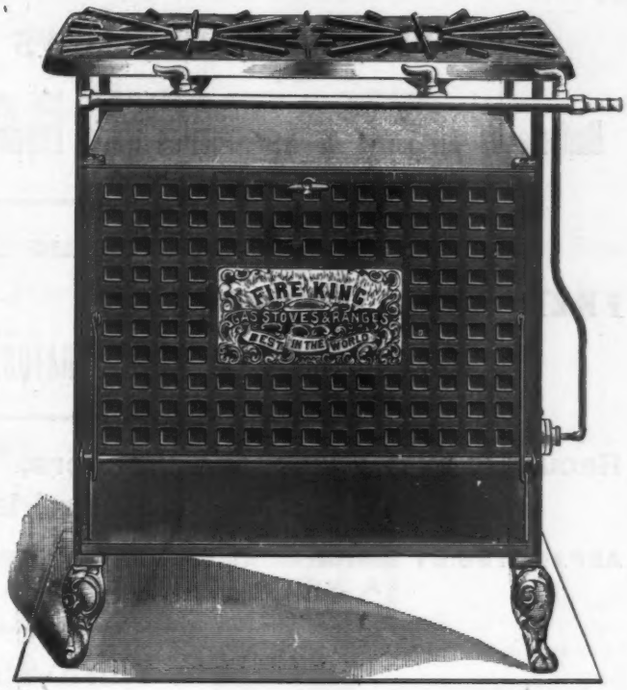
LOW PRICED GAS RANGES.

Just the thing for these Hard Times. Will cook for a large family. Write for catalogue and discounts. A full line of all kinds of Gas Stoves and Ranges.



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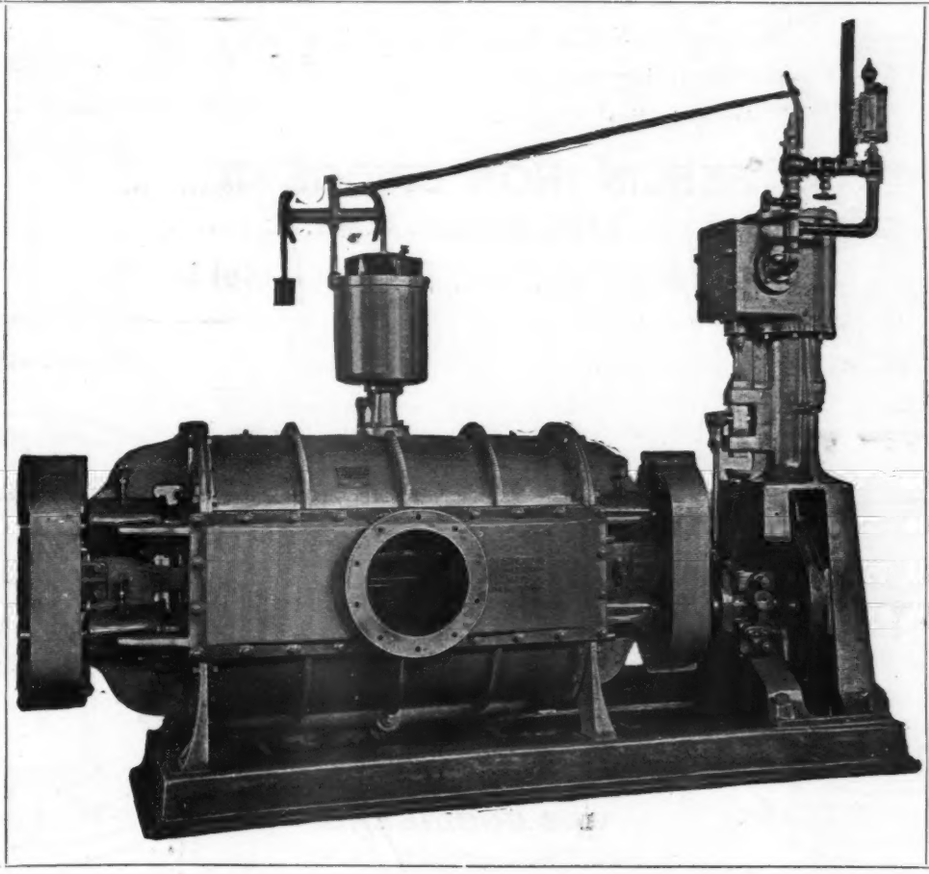

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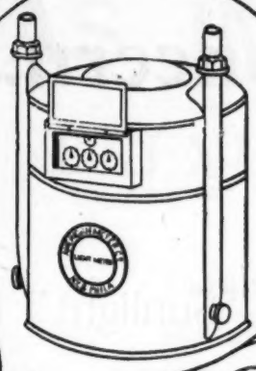
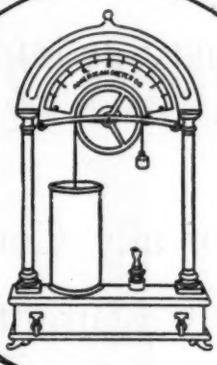
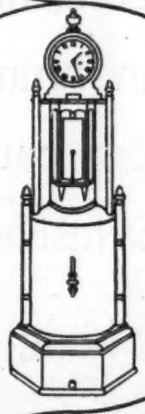
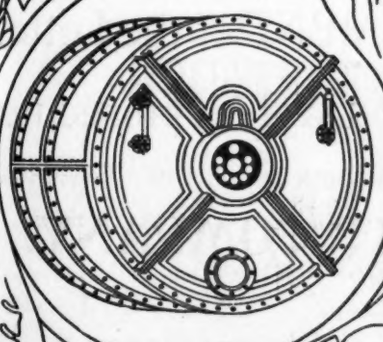








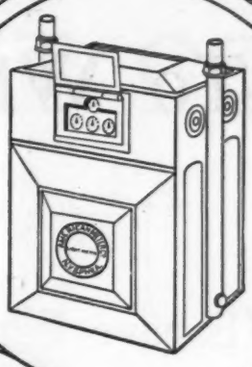
PUBLIC LIGHTING TABLE.

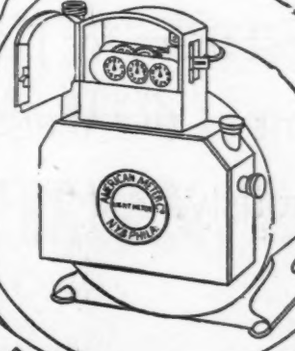
MAY, 1897.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M	A M.
Sat.	1	7.20 PM NM	4.00 AM	6 45	4.00
Sun.	2	7.30	4.00	6.45	4.00
Mon.	3	7.30	4 00	6.45	4.00
Tue.	4	7.30	4.00	6.45	4.00
Wed.	5	7.30	4.00	6.45	4.00
Thu.	6	10.40	4.00	6.45	4.00
Fri.	7	11.10	4.00	6.55	3.40
Sat.	8	11.50	4.00	6.55	3.40
Sun.	9	12.10 AM FQ	3.50	6.55	3.40
Mon.	10	12.40	3.50	6.55	3.40
Tue.	11	1.10	3.50	6.55	3.40
Wed.	12	1.30	3.50	6.55	3.40
Thu.	13	2.00	3.50	6.55	3.40
Fri.	14	No L.	No L.	7.00	3 30
Sat.	15	No L. FM	No L.	7.00	3.30
Sun.	16	No L.	No L.	7.00	3.30
Mon.	17	7.40 PM	10.10 PM	7.00	3.30
Tue.	18	7.40	11.10	7.00	3.30
Wed.	19	7.40	12.00 AM	7.00	3.30
Thu.	20	7.40	12.40	7.00	3.30
Fri.	21	7.40	1.10	7.10	3.15
Sat.	22	7.40 LQ	1.40	7.10	3.15
Sun.	23	7.50	2.00	7.10	3.15
Mon.	24	7.50	2.20	7.10	3.15
Tue.	25	7.50	2.40	7.10	3.15
Wed.	26	7.50	3.00	7.10	3.15
Thu.	27	7.50	3.40	7.10	3.15
Fri.	28	7.50	3.40	7.15	3.15
Sat.	29	7.50	3.40	7.15	3.15
Sun.	30	7.50 NM	3.30	7.15	3.15
Mon.	31	7.50	3.30	7.15	3 15

TOTAL HOURS LIGHTING DURING 1897.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	233.00	January	423.20
February	187.20	February	355 25
March	202.00	March	355.35
April	170.40	April	298.50
May	163.00	May	264.50
June	140.40	June	234.25
July	151 40	July	243.45
August	167.30	August	280.25
September	174.40	September	321.15
October	200.00	October	374.30
November	205.20	November	401.40
December	220.10	December	433.45
Total, yr.	2216.00	Total, yr.	3987.45





To Whom It May Concern.

WE have learned that the makers of the "Sunlight" lamp assert that there has been a decision in the English Courts which saves them and their customers from liability as infringers of the Welsbach patents.

We assure the public there is no decision of any Court, in England or elsewhere, that directly or indirectly warrants the statement or inference that the lamp sold by the Sunlight Incandescent Gas Lamp Company of America is not an infringement of the Welsbach Light as made under the American patents, of which the Welsbach Light Company is sole and exclusive owner.

NOTICE is hereby given to all PURCHASERS and USERS of the so-called "Sunlight" lamp that suits will be brought against them for DAMAGES for INFRINGEMENT of the Letters Patent of the Welsbach Light Company, and will be prosecuted vigorously.

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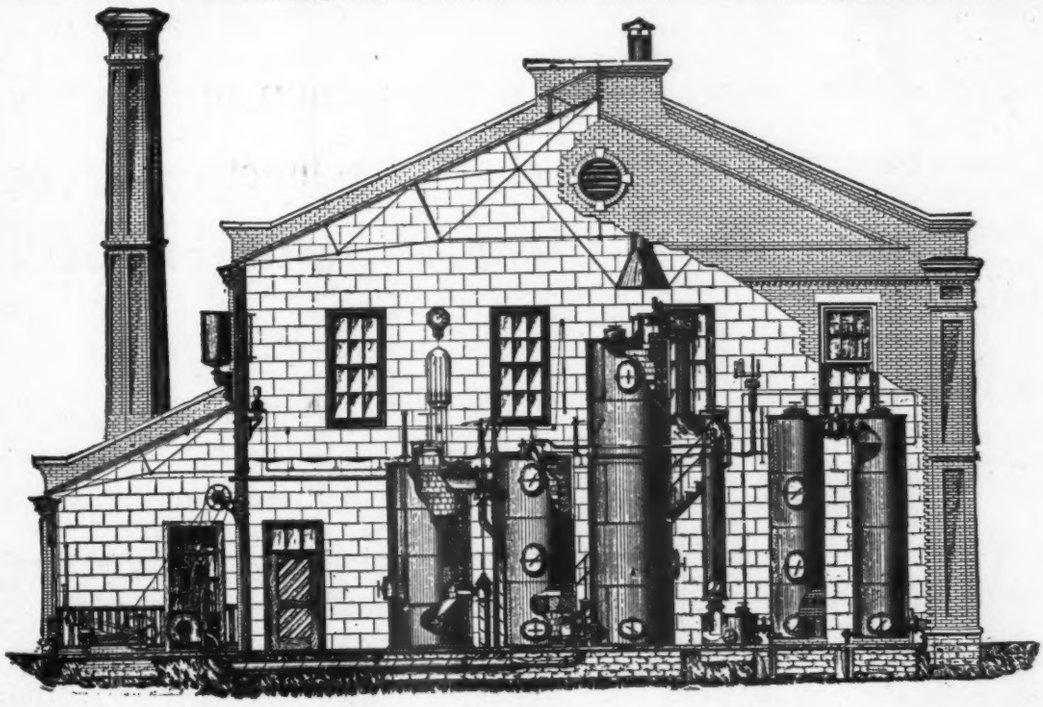

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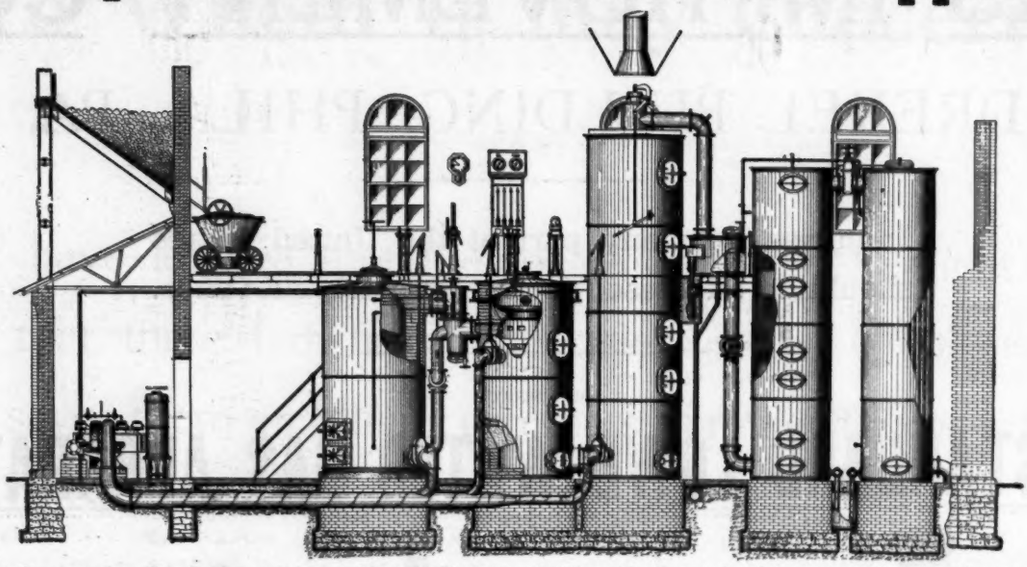

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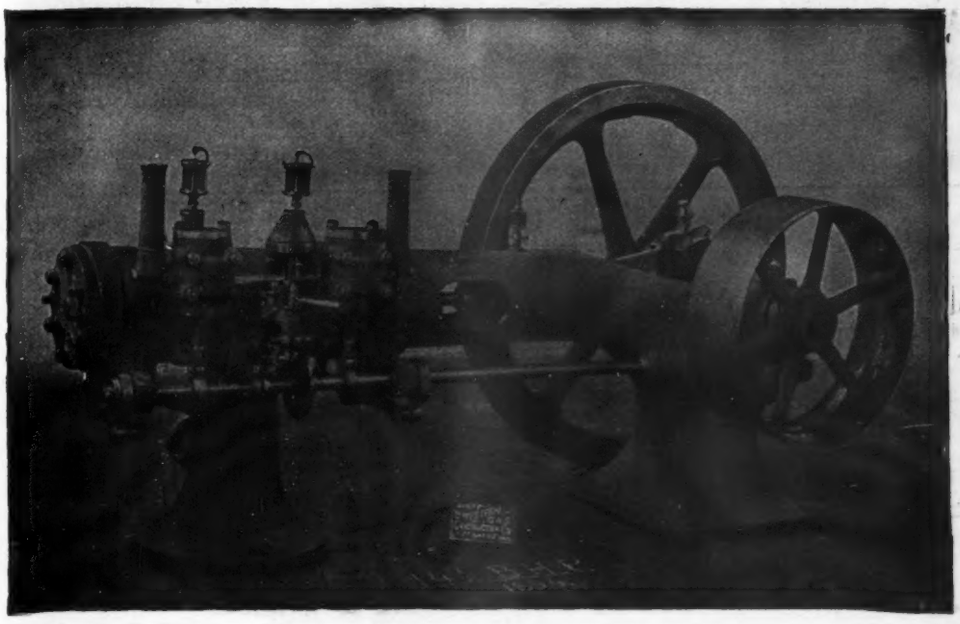

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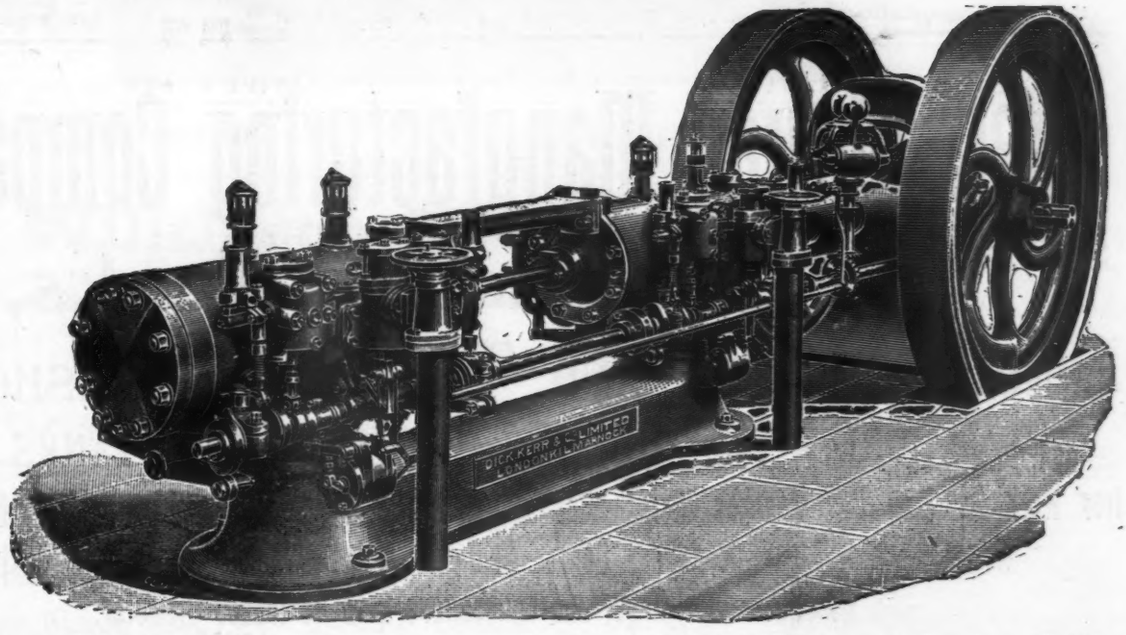

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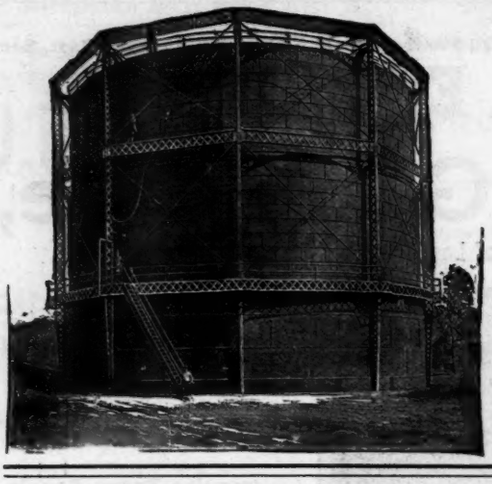

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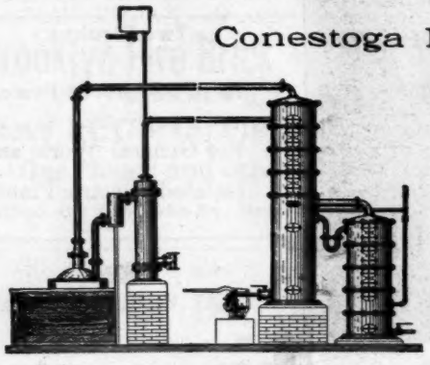

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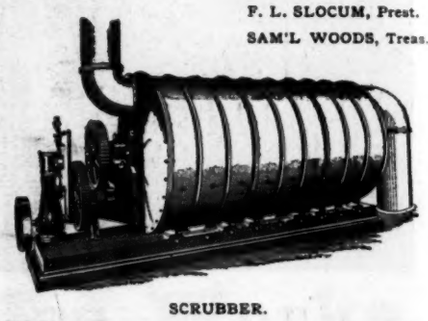

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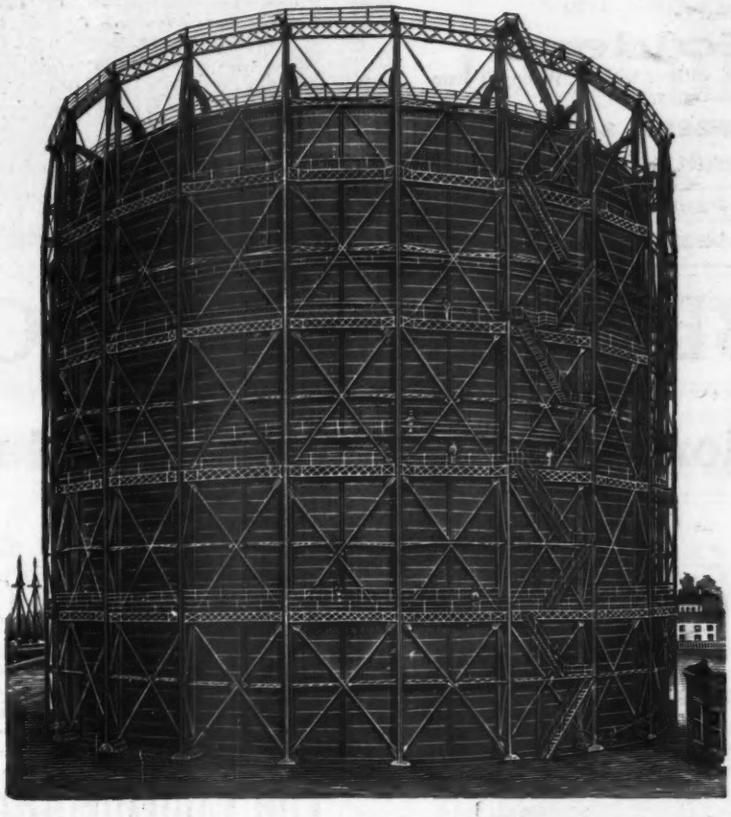

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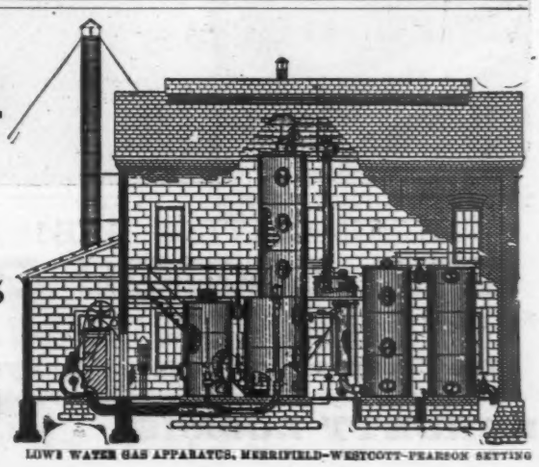

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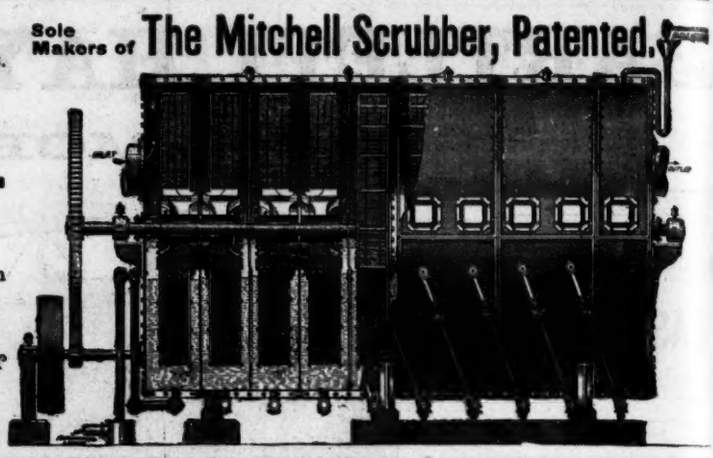

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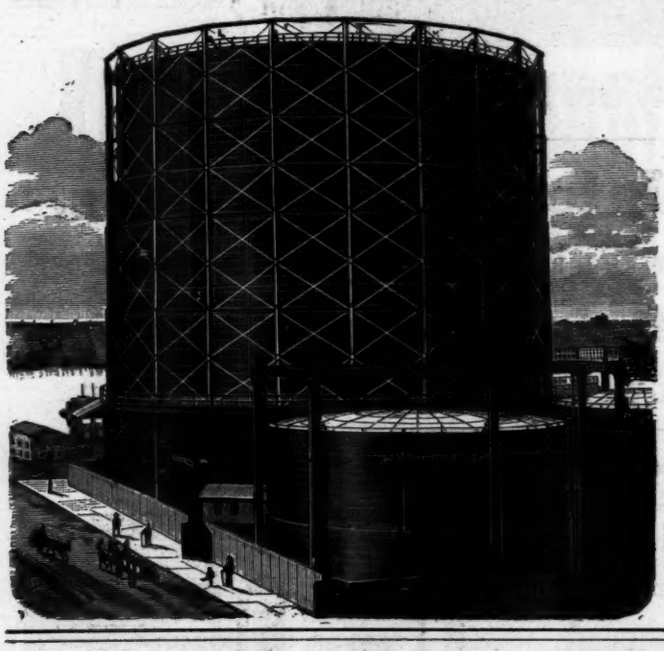

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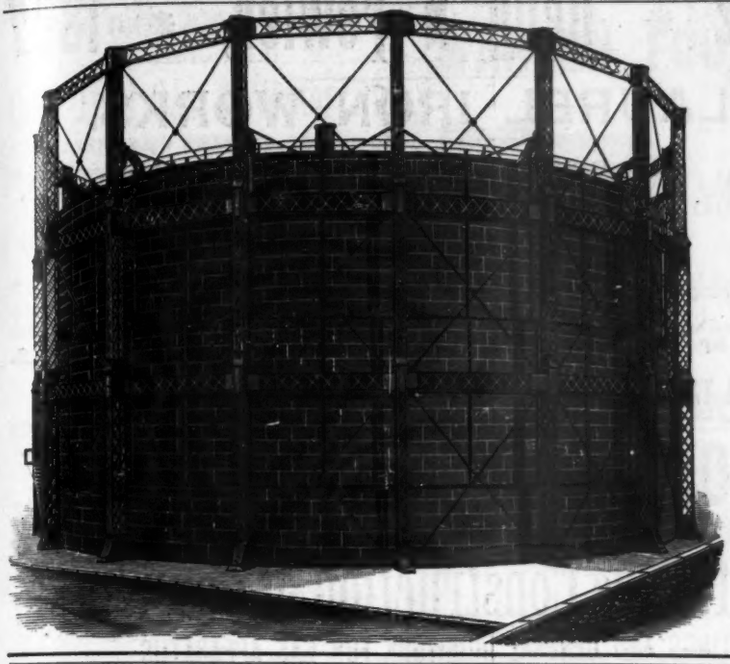

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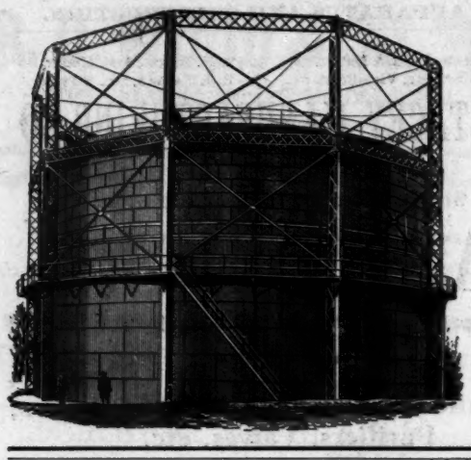

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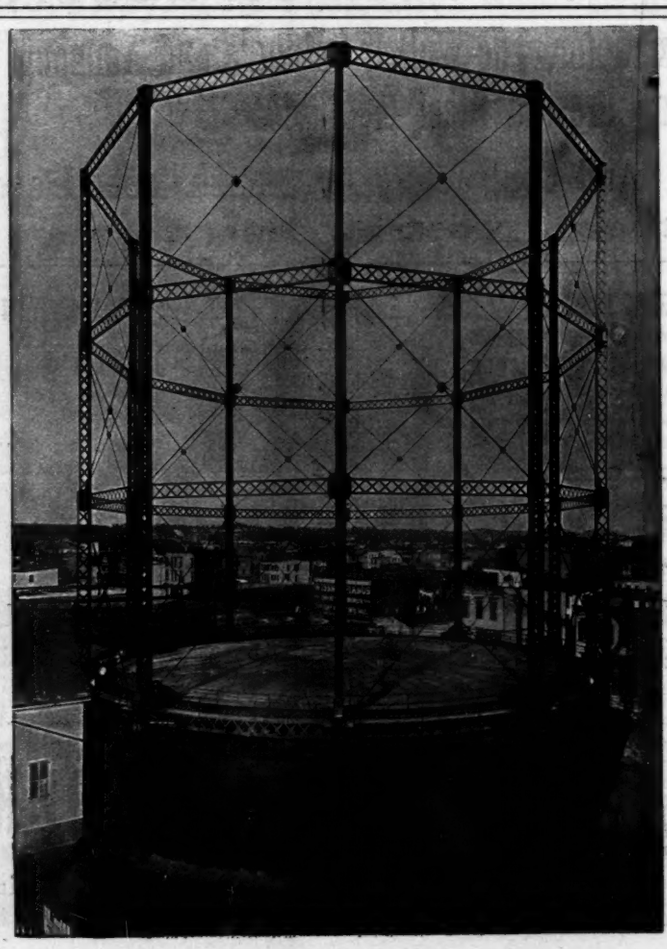

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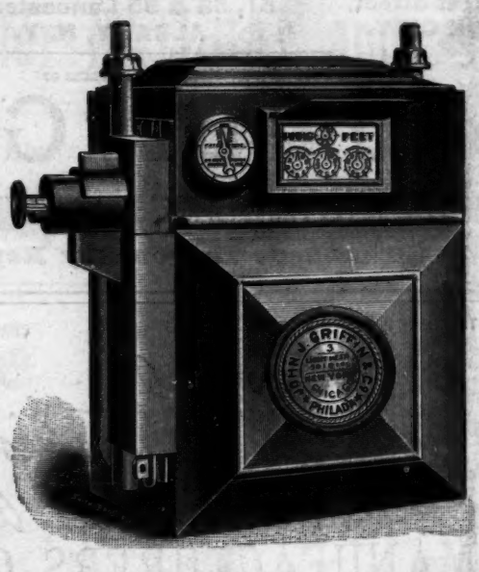

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